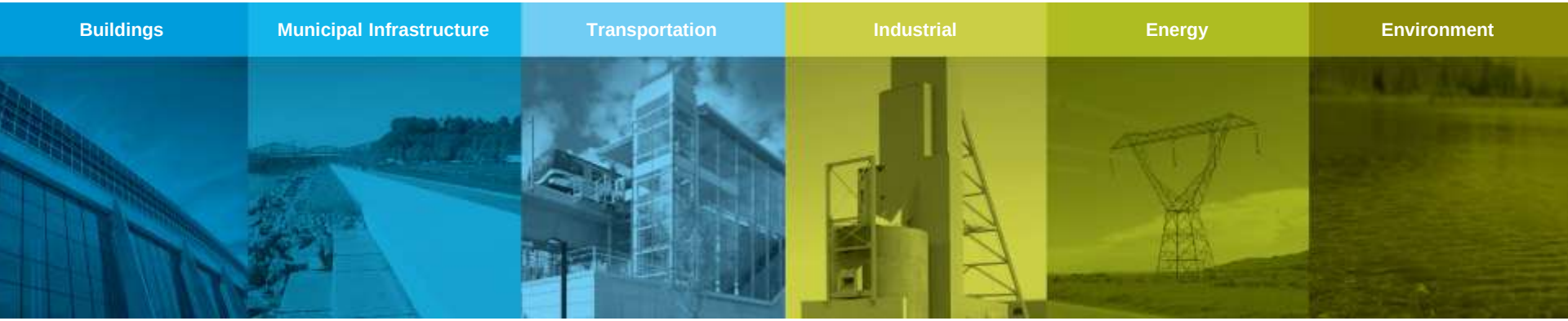
AWEA Wind Resource & Project Energy Assessment Seminar

Industry Standards Survey

Rob Istchenko, P.Eng.

September 14, 2012



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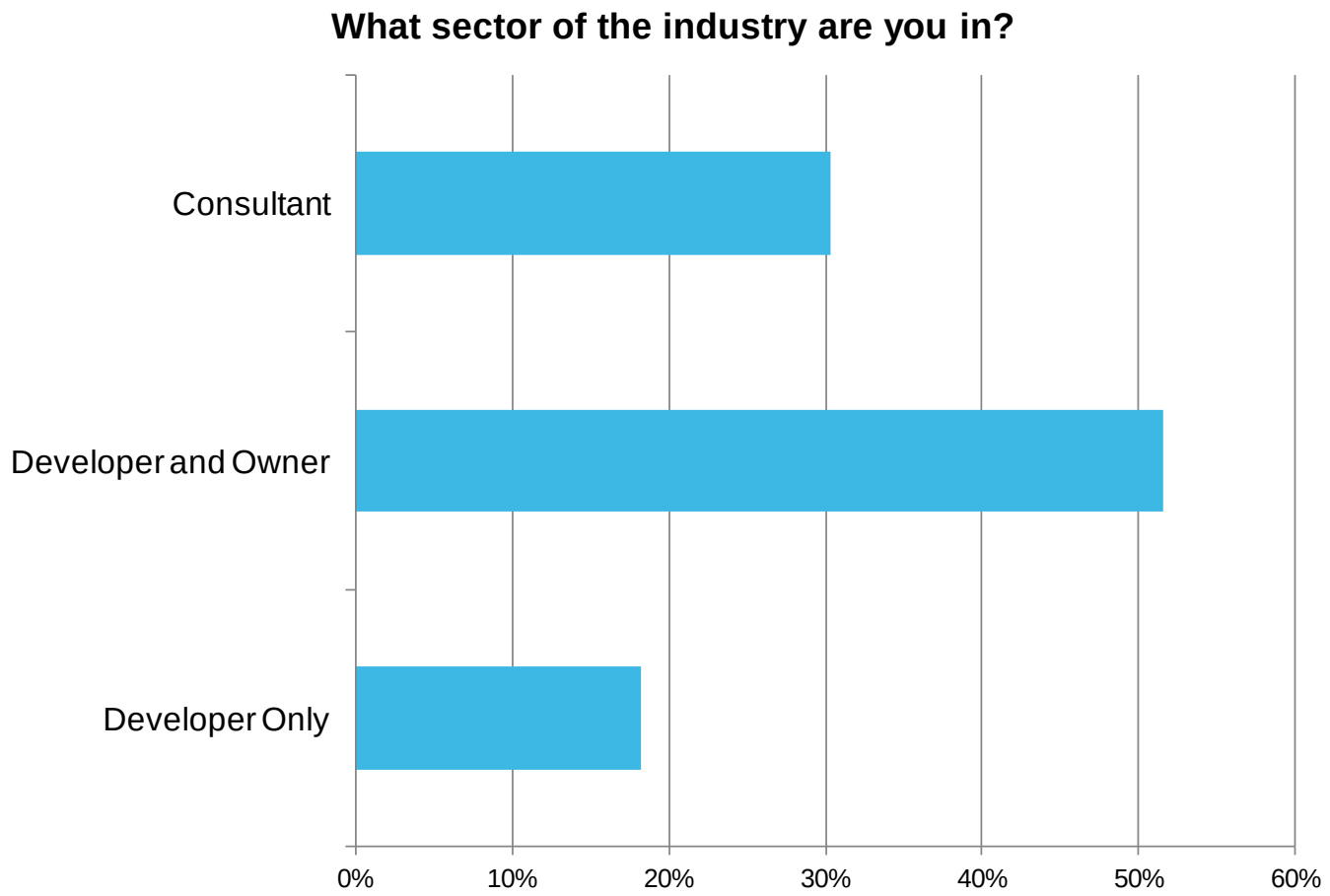
OUTLINE

- Overview of Survey
- Demographics
- Meteorological Campaigns
- Setbacks and Turbine Siting
- Layout Optimization
- Suitability Considerations
- Comments and Conclusions

OVERVIEW OF SURVEY

- Survey of industry professionals re decisions that are central to WRA activities, but aren't always included in core technical discussion
- Gain insight into considerations that influence decisions
- Hope to provide a window into variation in practices, not necessarily to make recommendations regarding a "standard"
- In order to maintain anonymity and for simplicity, results have been binned
- 36 respondents

DEMOGRAPHICS



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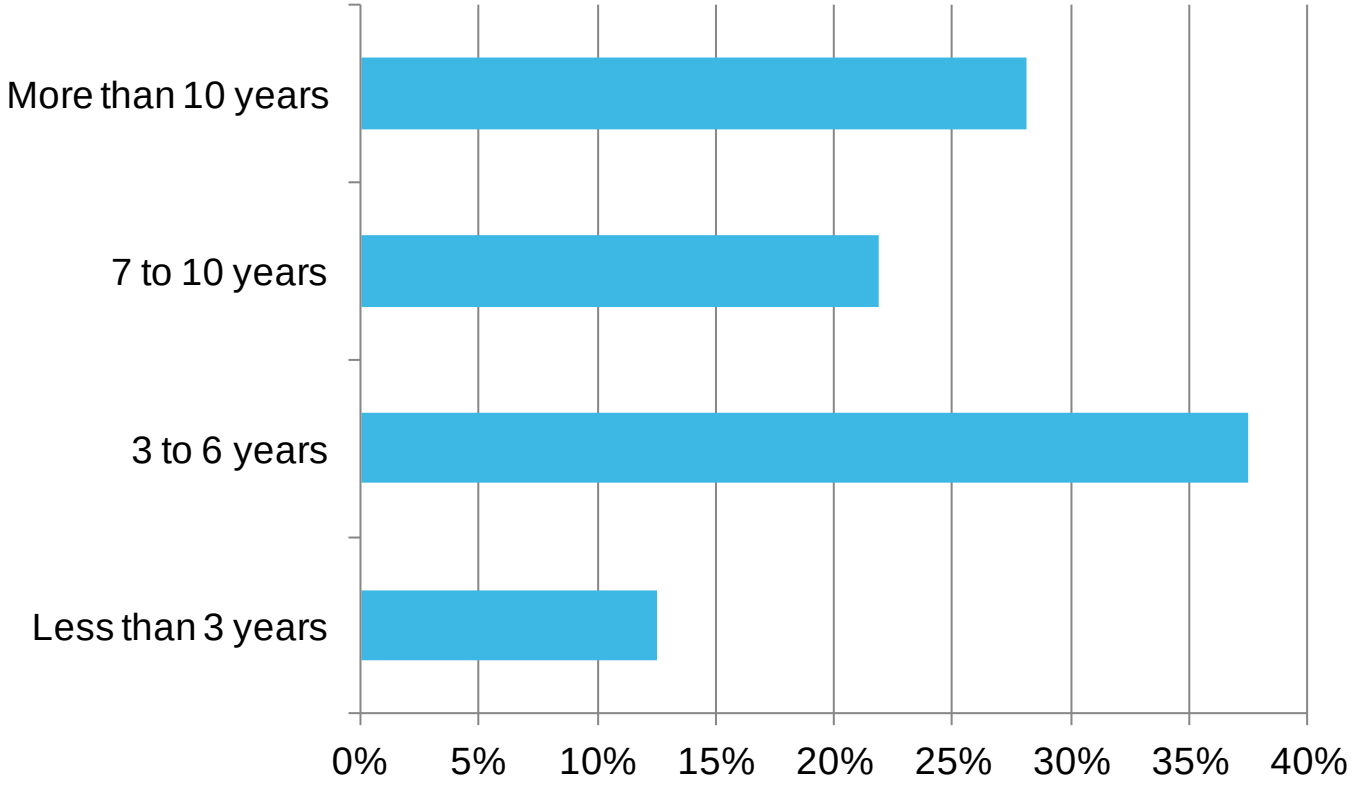
DEMOGRAPHICS

What period of time does your organization's experience with advanced stage turbine siting span?



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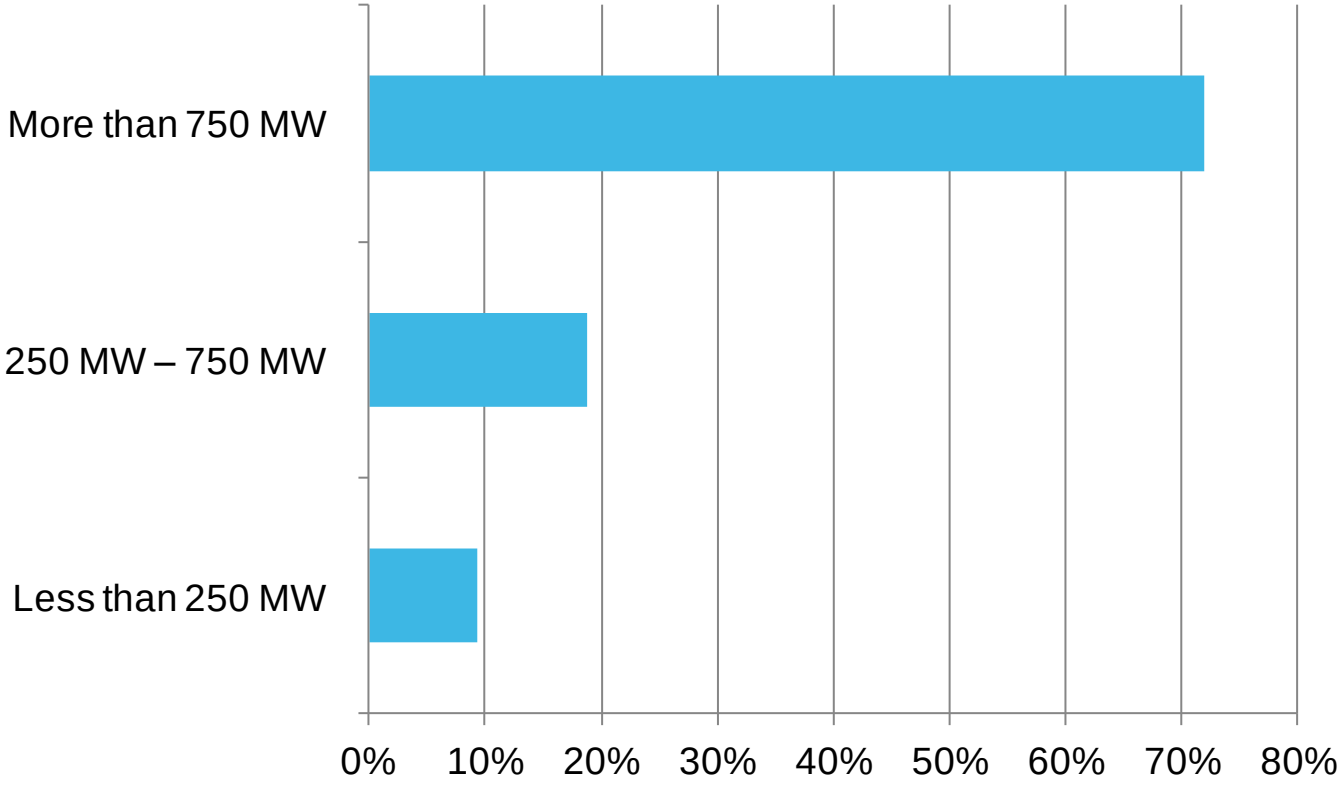
DEMOGRAPHICS

In how many MW of completed wind projects has your company been involved?



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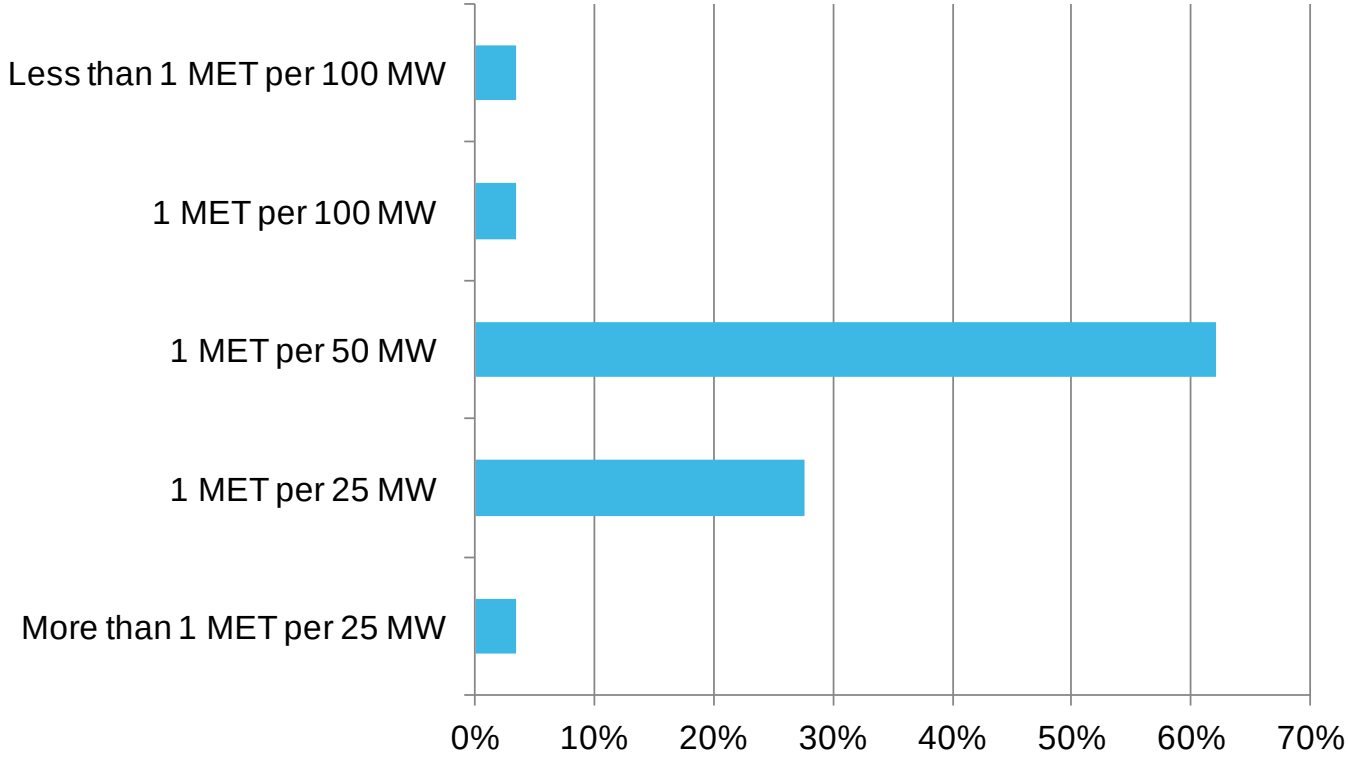
METEOROLOGICAL CAMPAIGNS

Which choice most closely represents the type of pre-construction MET tower coverage you typically have on your wind power sites as they go into construction?



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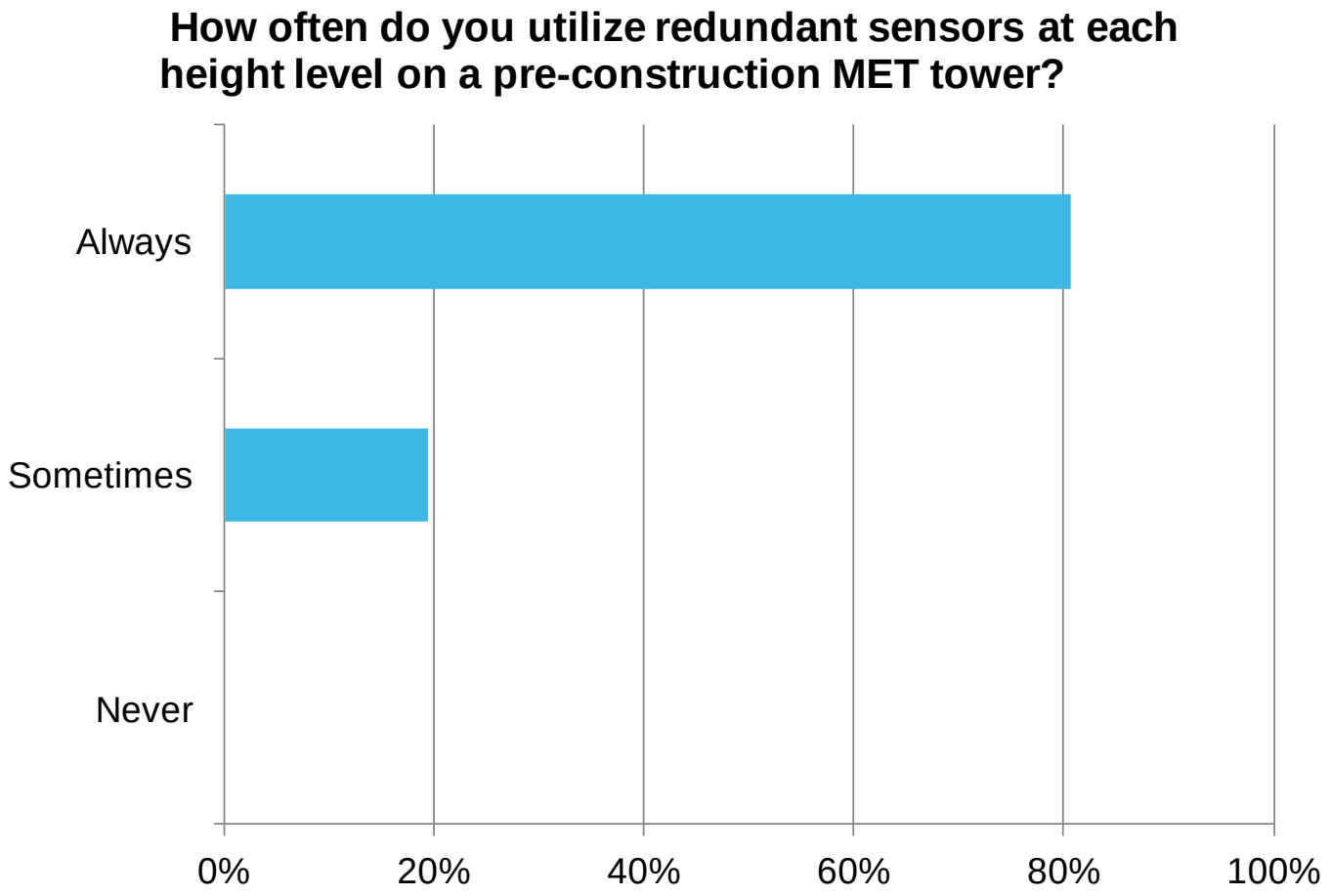
METEOROLOGICAL CAMPAIGNS



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METEOROLOGICAL CAMPAIGNS

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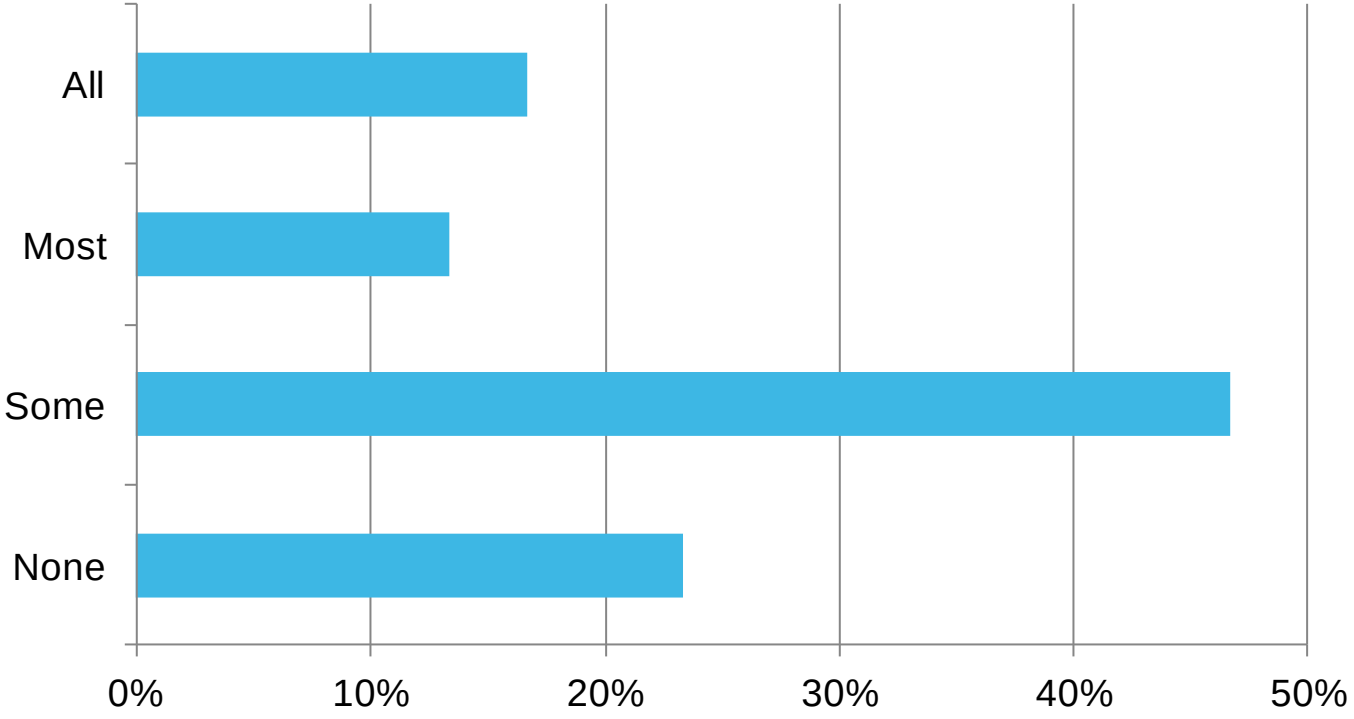
METEOROLOGICAL CAMPAIGNS

For your standard pre-construction MET tower configuration, how many of your anemometers are Class I sensors?



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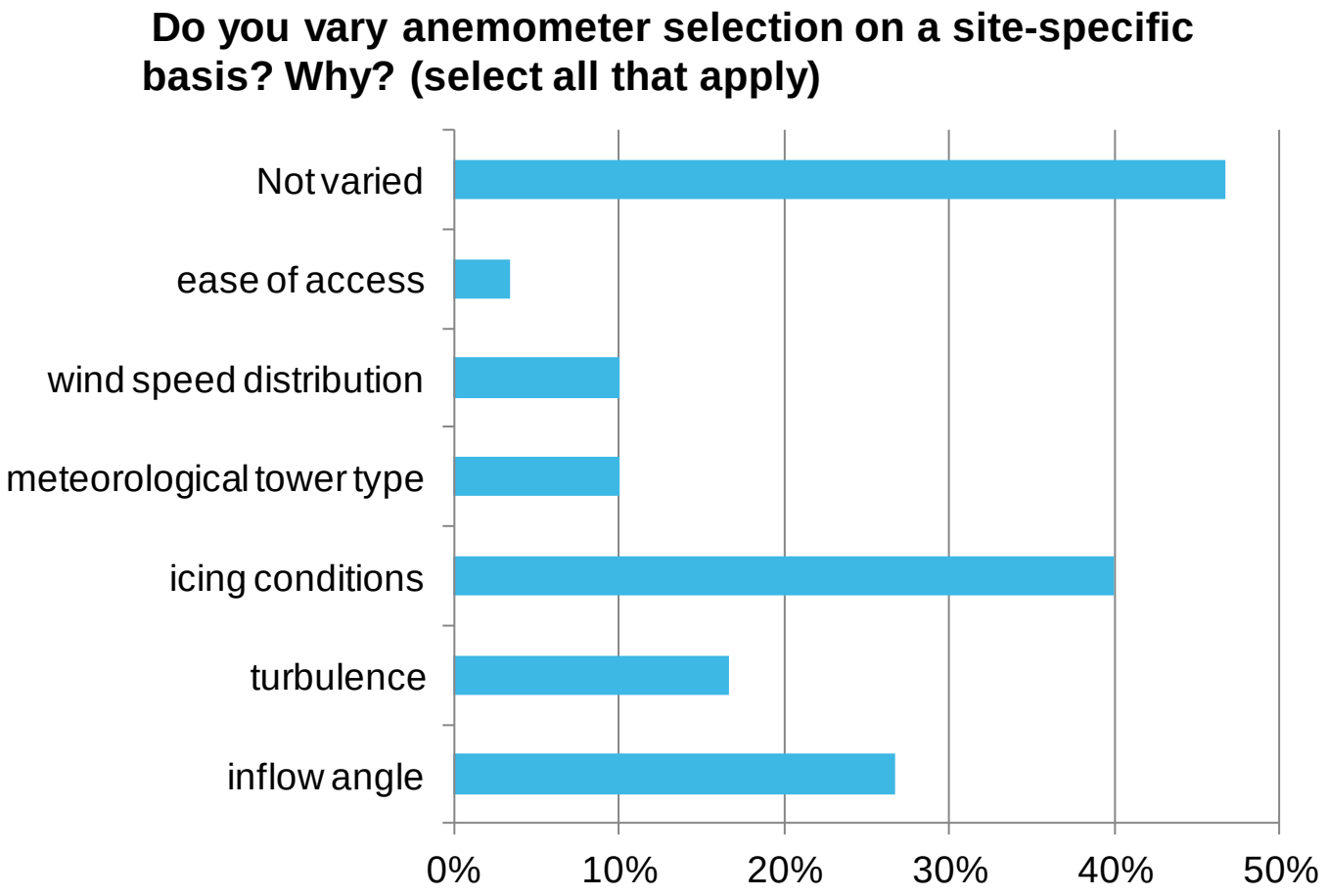
METEOROLOGICAL CAMPAIGNS



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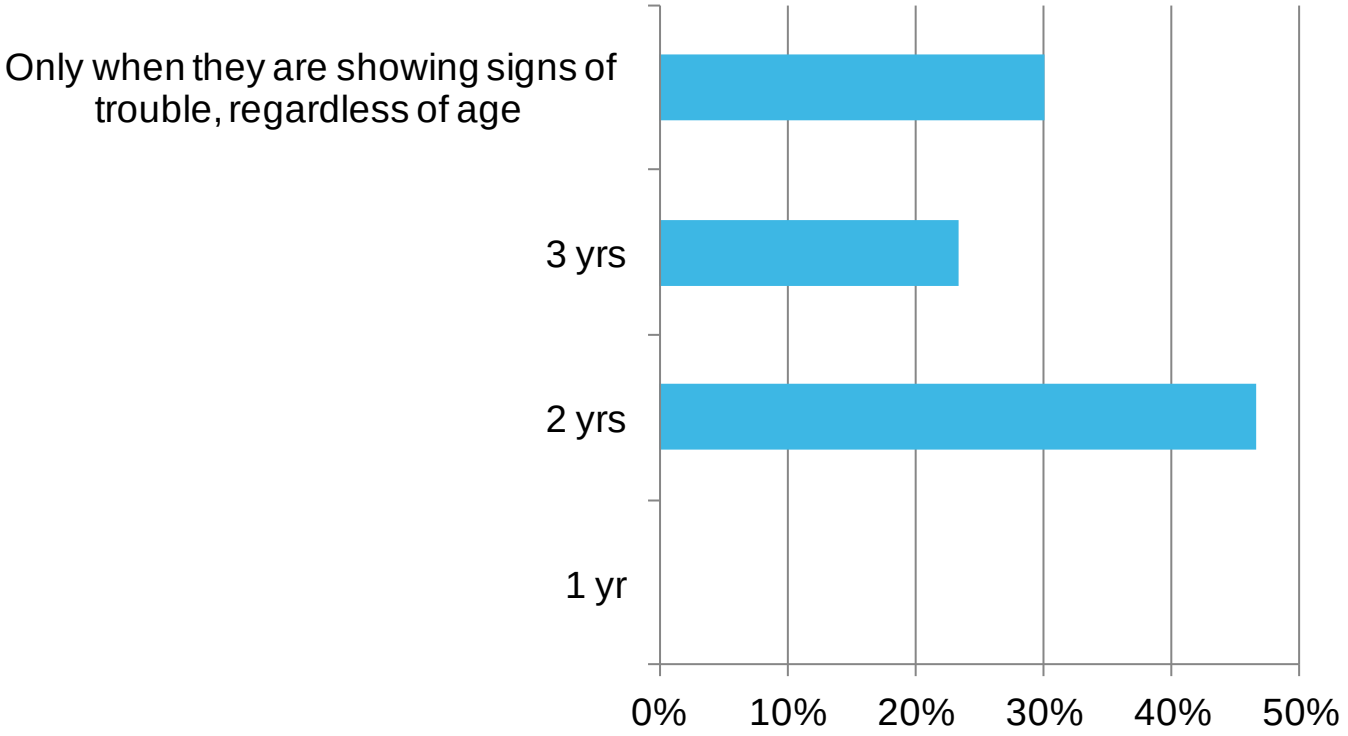
METEOROLOGICAL CAMPAIGNS

If they are not showing any indications of problems, is there an age at which you typically decide to replace anemometers?



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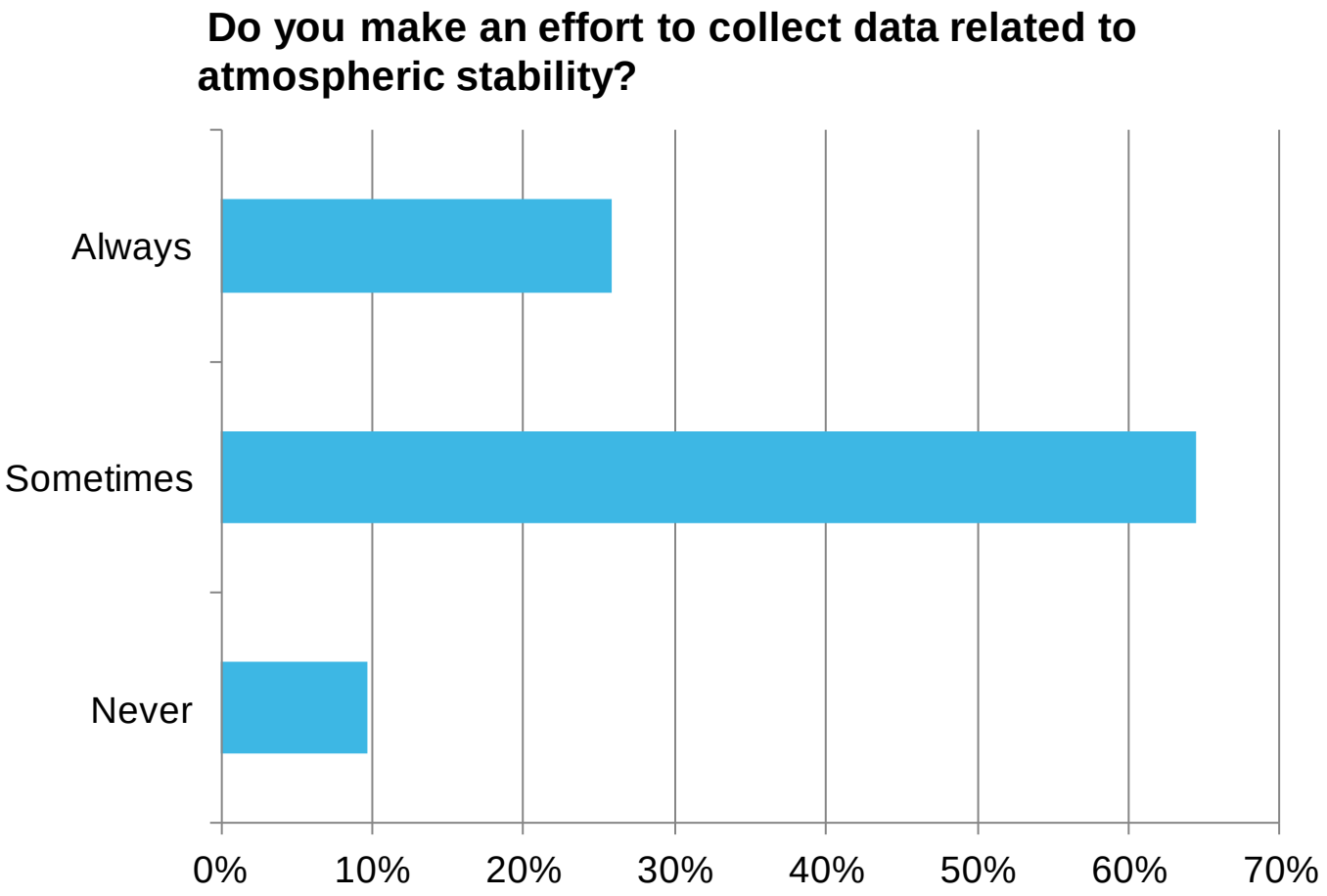
METEOROLOGICAL CAMPAIGNS



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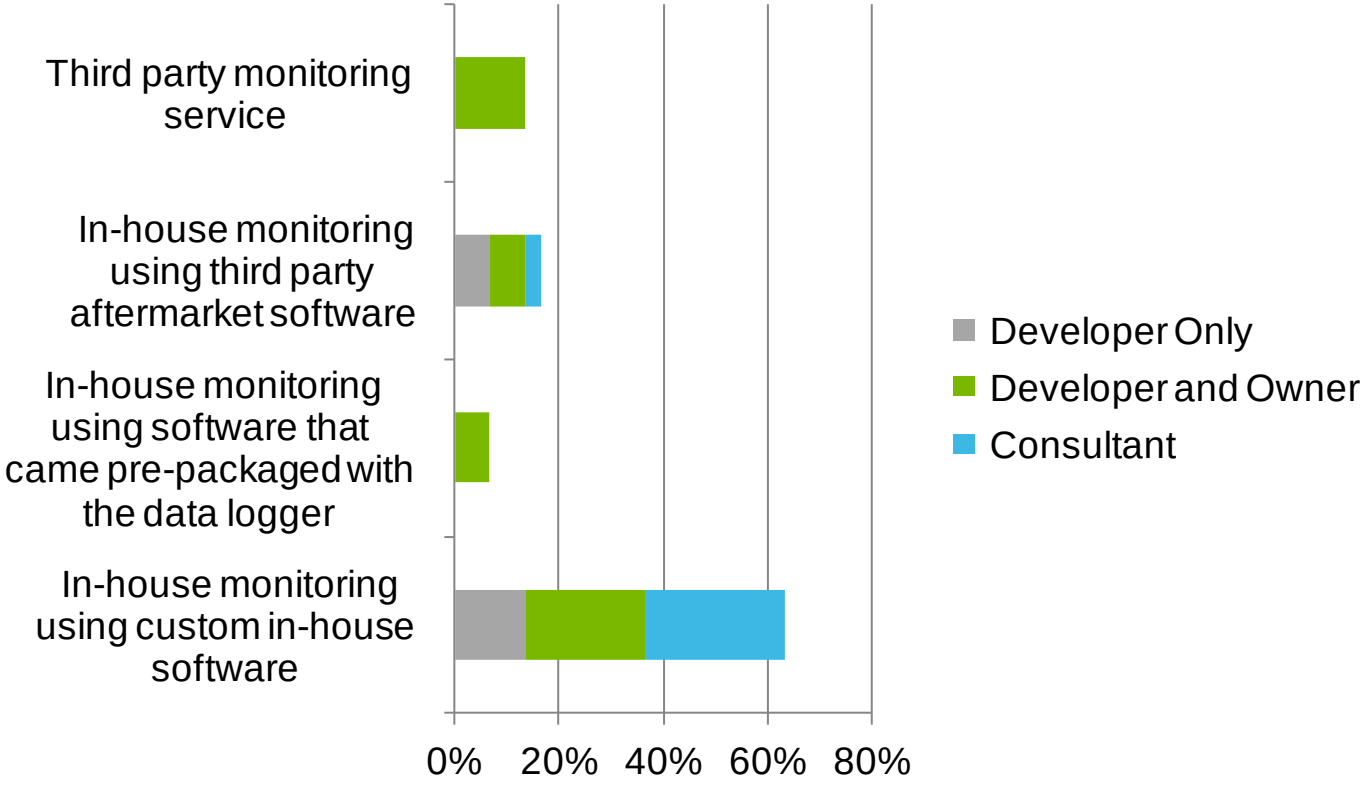
METEOROLOGICAL CAMPAIGNS

What methods do you use to ensure that your in-field sensors are working properly? (check all that apply)



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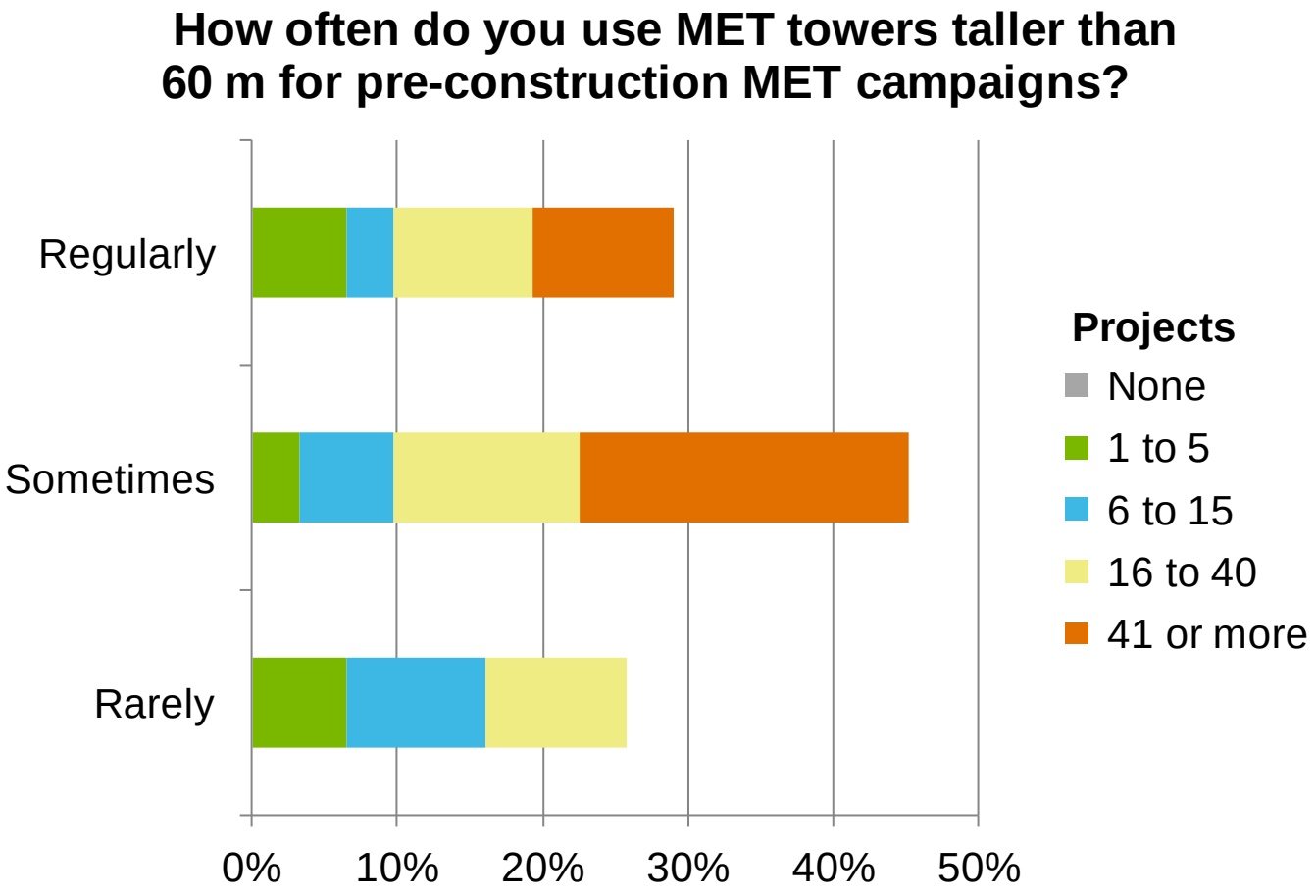
METEOROLOGICAL CAMPAIGNS



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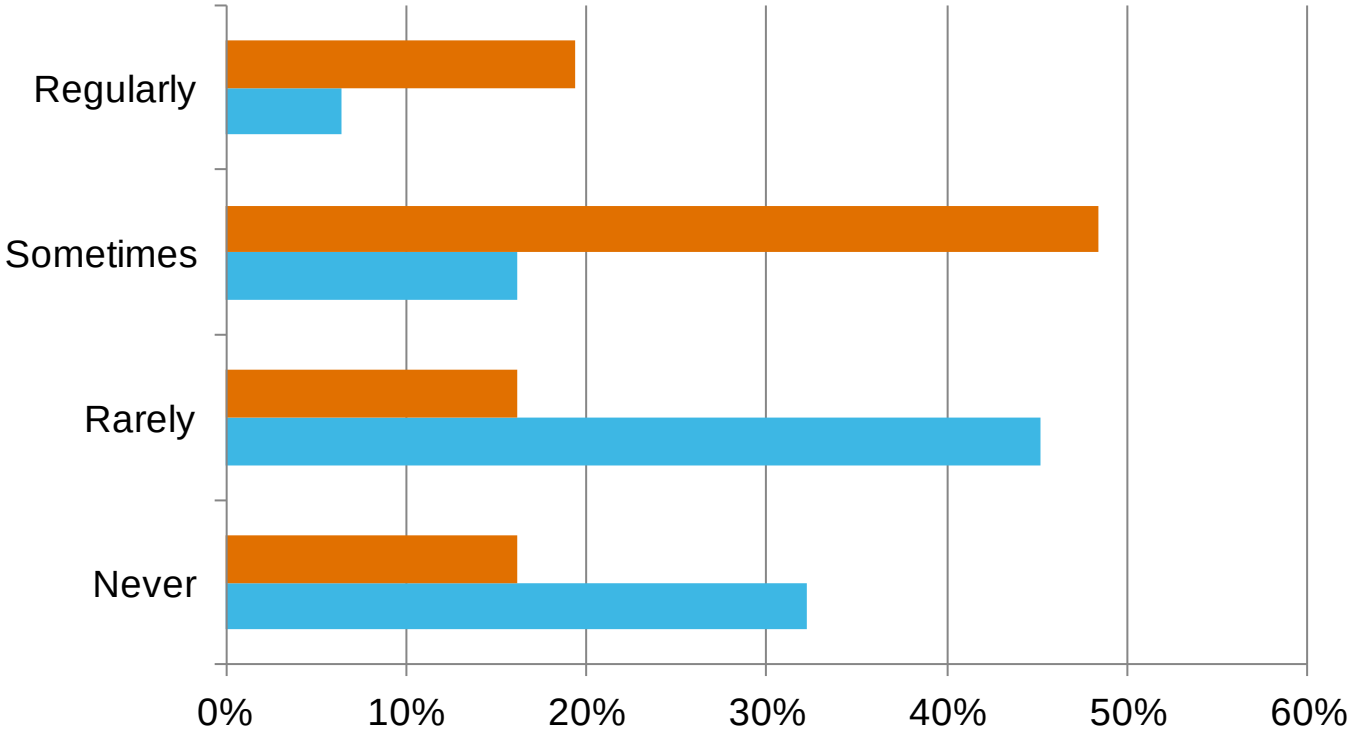
METEOROLOGICAL CAMPAIGNS

How often do you utilize SODAR / LIDAR in your pre-construction MET campaigns?



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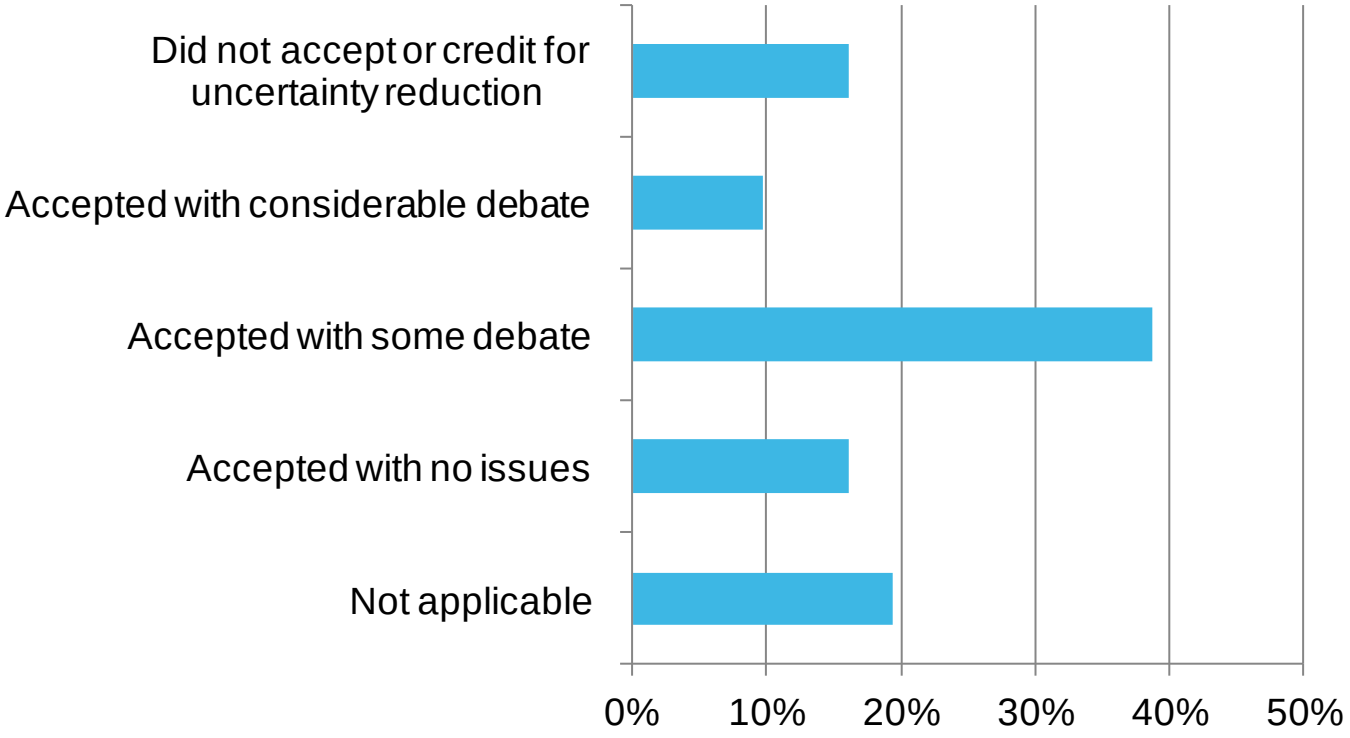
METEOROLOGICAL CAMPAIGNS

How have third party engineers and financing entities viewed remote sensing data from your pre-construction MET campaigns?



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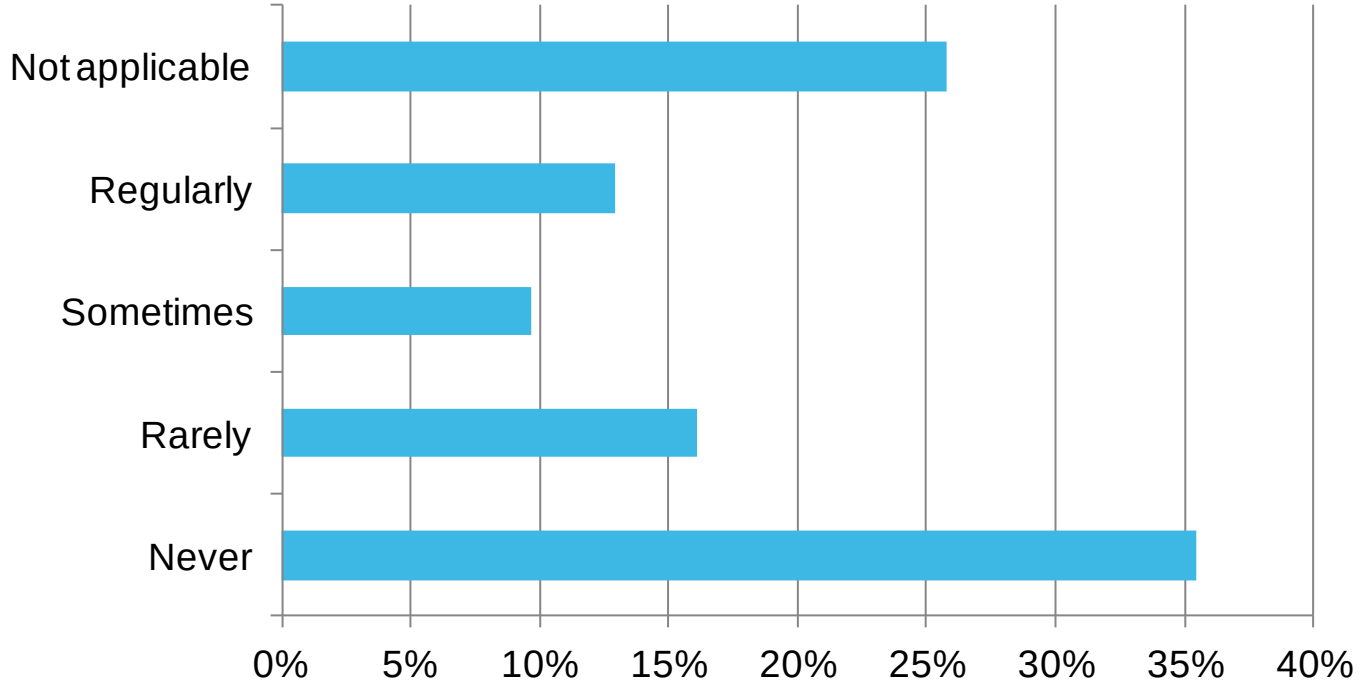
METEOROLOGICAL CAMPAIGNS

FAA requires that a report be filed for construction of structures greater than 200' above ground level (AGL). How often do you make FAA filings for MET towers that fall below 200' AGL?



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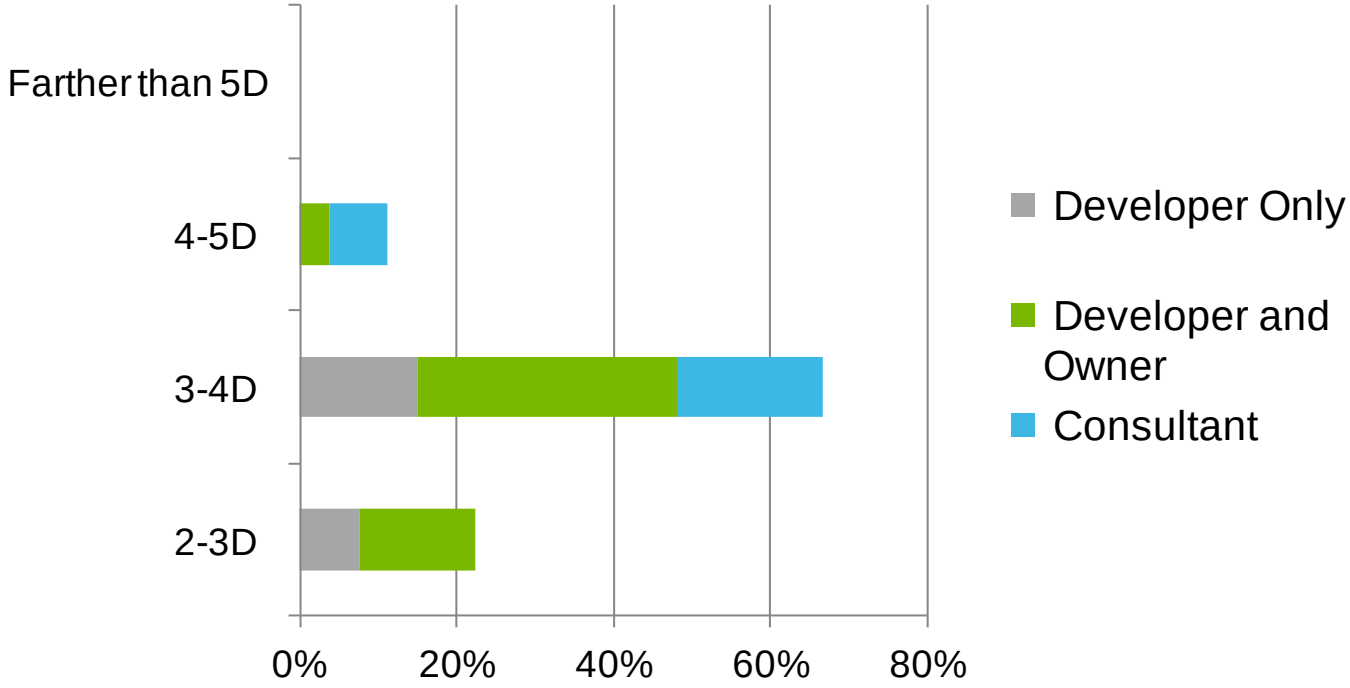
SETBACKS AND TURBINE SITING

When designing a wind turbine array with linear strings, what is the rule of thumb you use for spacing between turbines in-row (please state distance as a function of rotor diameters)?



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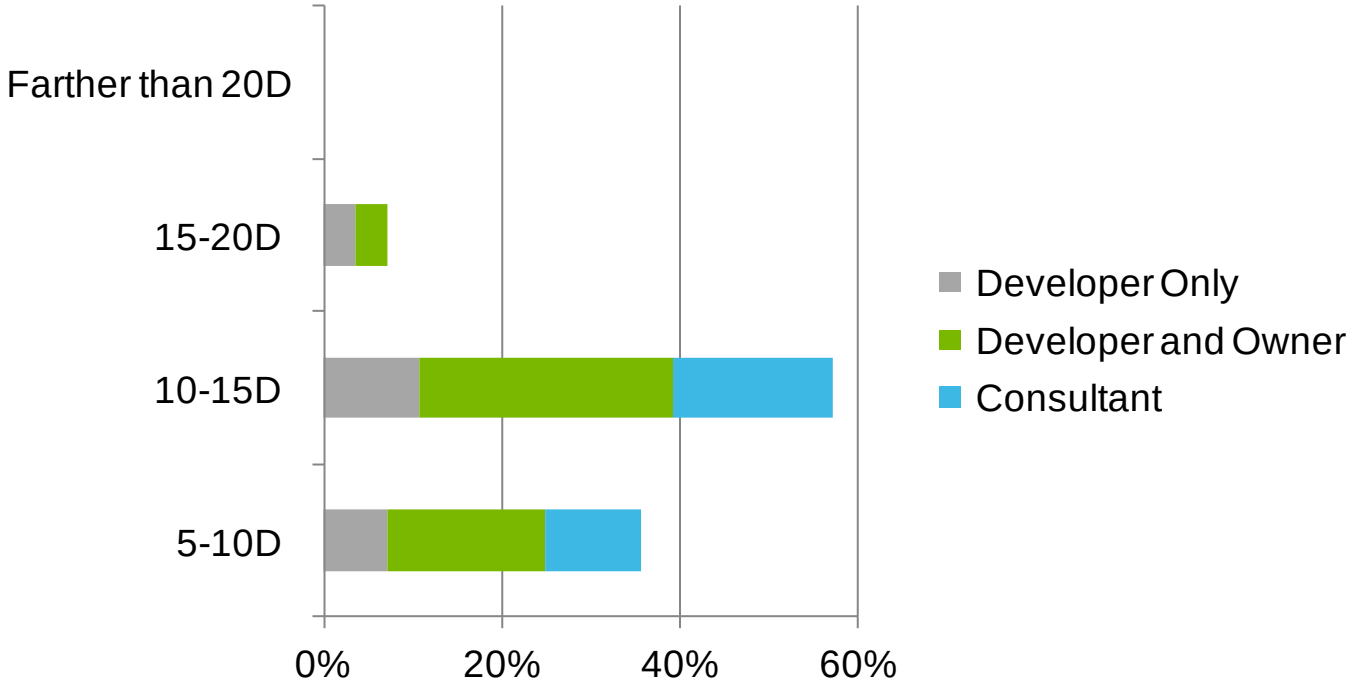
When designing a wind turbine array with linear strings, what is the rule of thumb you use for spacing between turbine rows (please state distance as a function of rotor diameters)?



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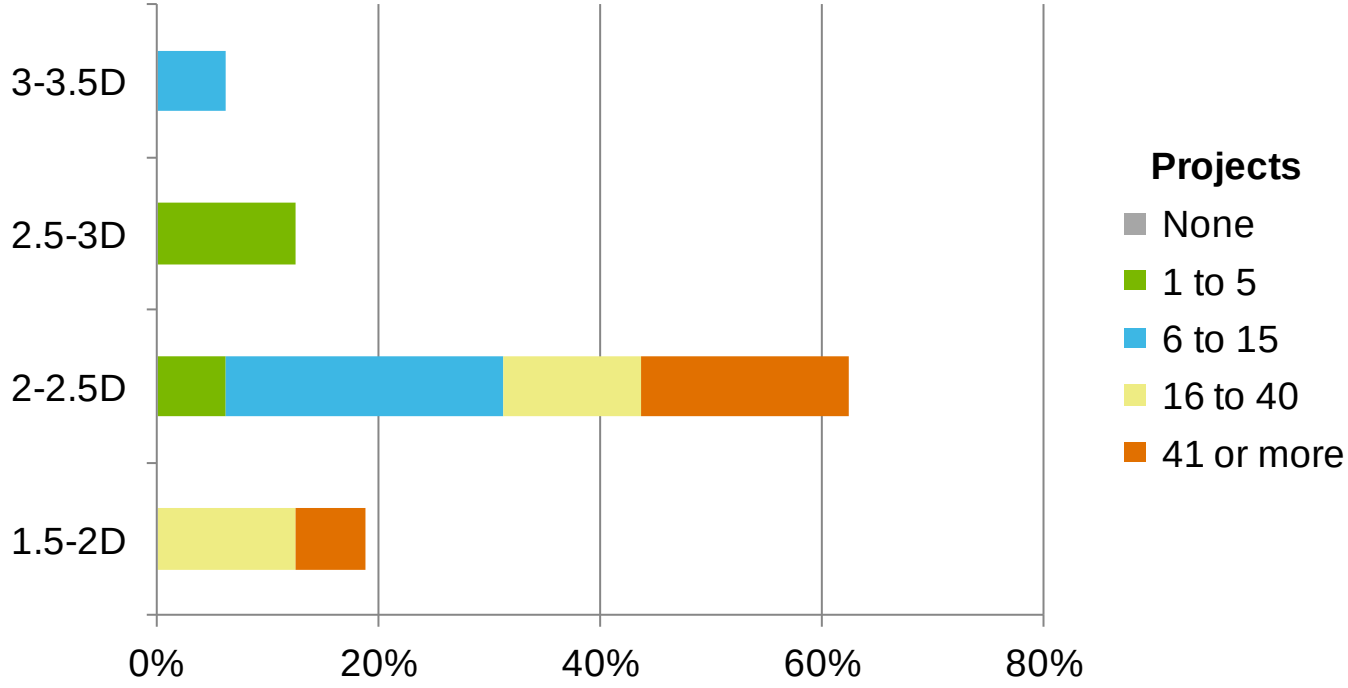
SETBACKS AND TURBINE SITING

What is the minimum turbine spacing you have seen approved for construction by a turbine vendor in the non-prevailing wind direction (please state distance as a function of rotor diameters)?



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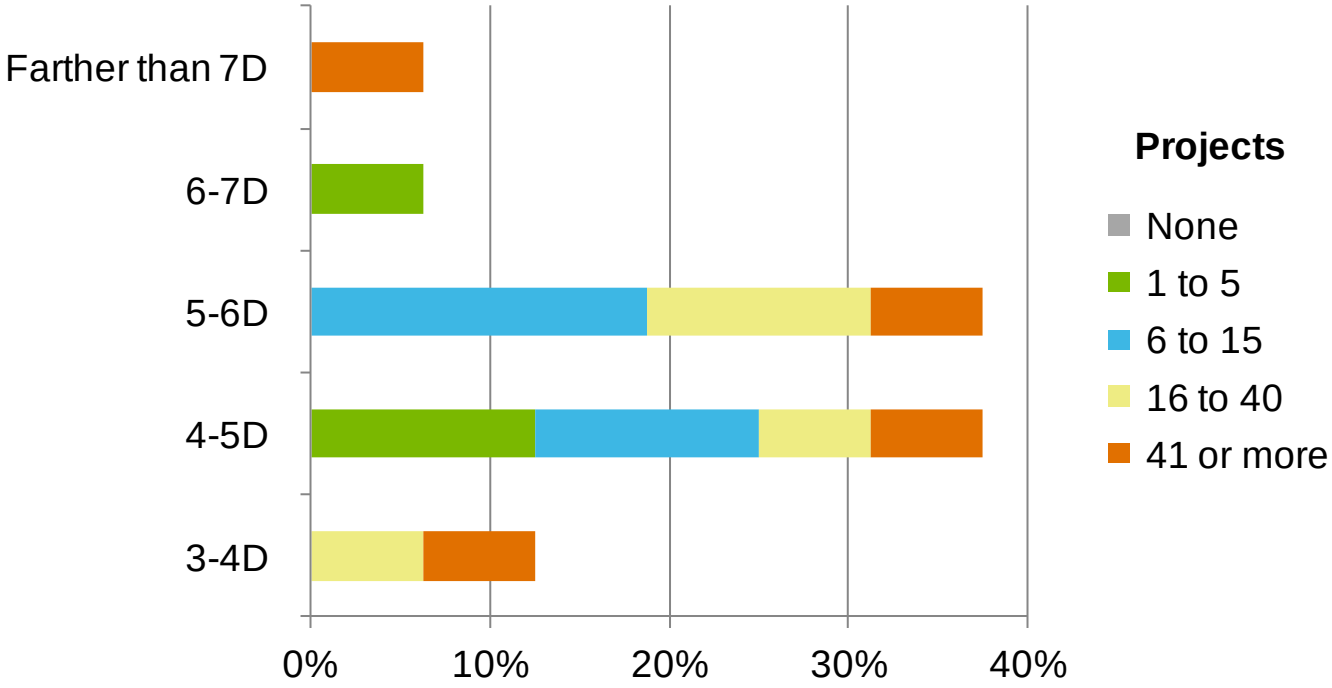
SETBACKS AND TURBINE SITING

What is the minimum turbine spacing you have seen approved for construction by a turbine vendor in the prevailing wind direction (please state distance as a function of rotor diameters)?



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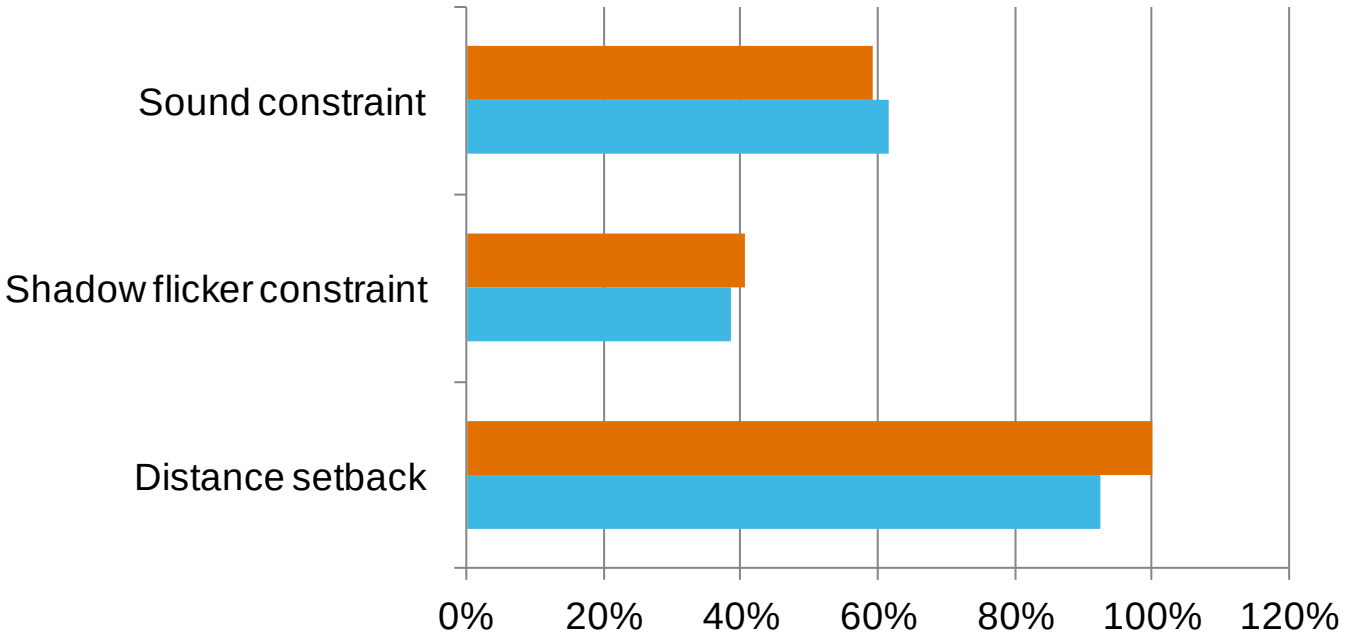
SETBACKS AND TURBINE SITING

In the absence of local or regional siting guidelines, select the considerations that are made for occupied buildings that are / are not participating in the wind project. Select all that apply.



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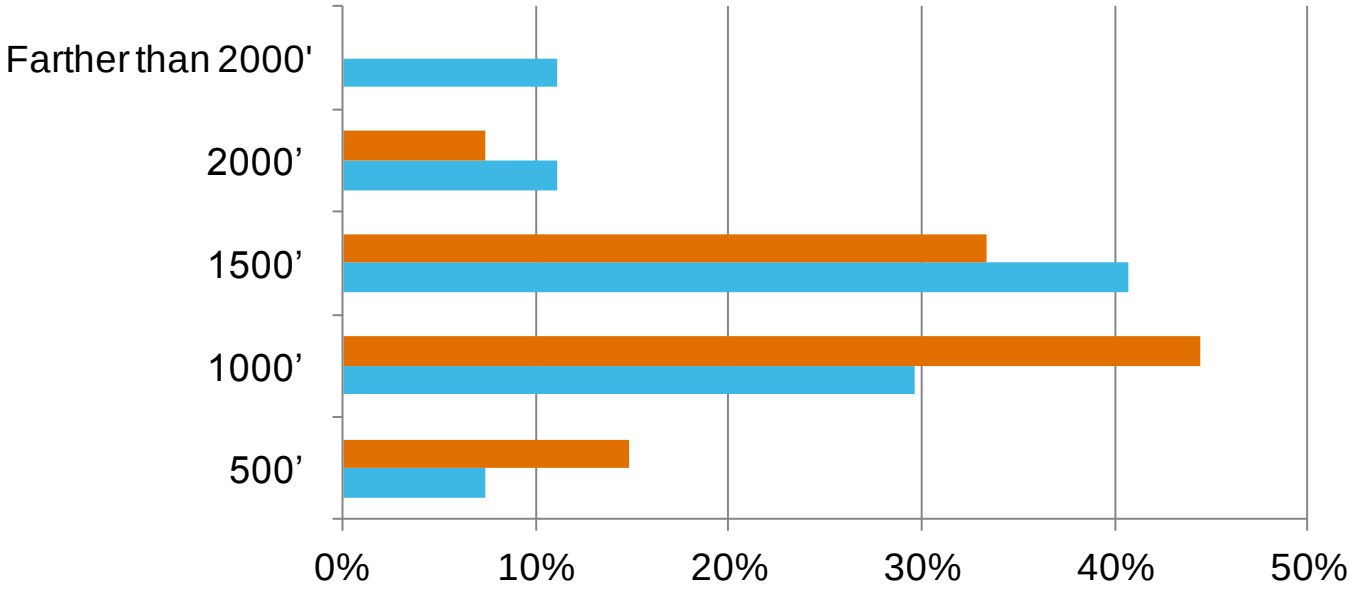
SETBACKS AND TURBINE SITING

In the absence of local or regional siting guidelines, which distance best characterizes the setback you typically use for wind turbines relative to occupied buildings that are / are not participating in the wind project?



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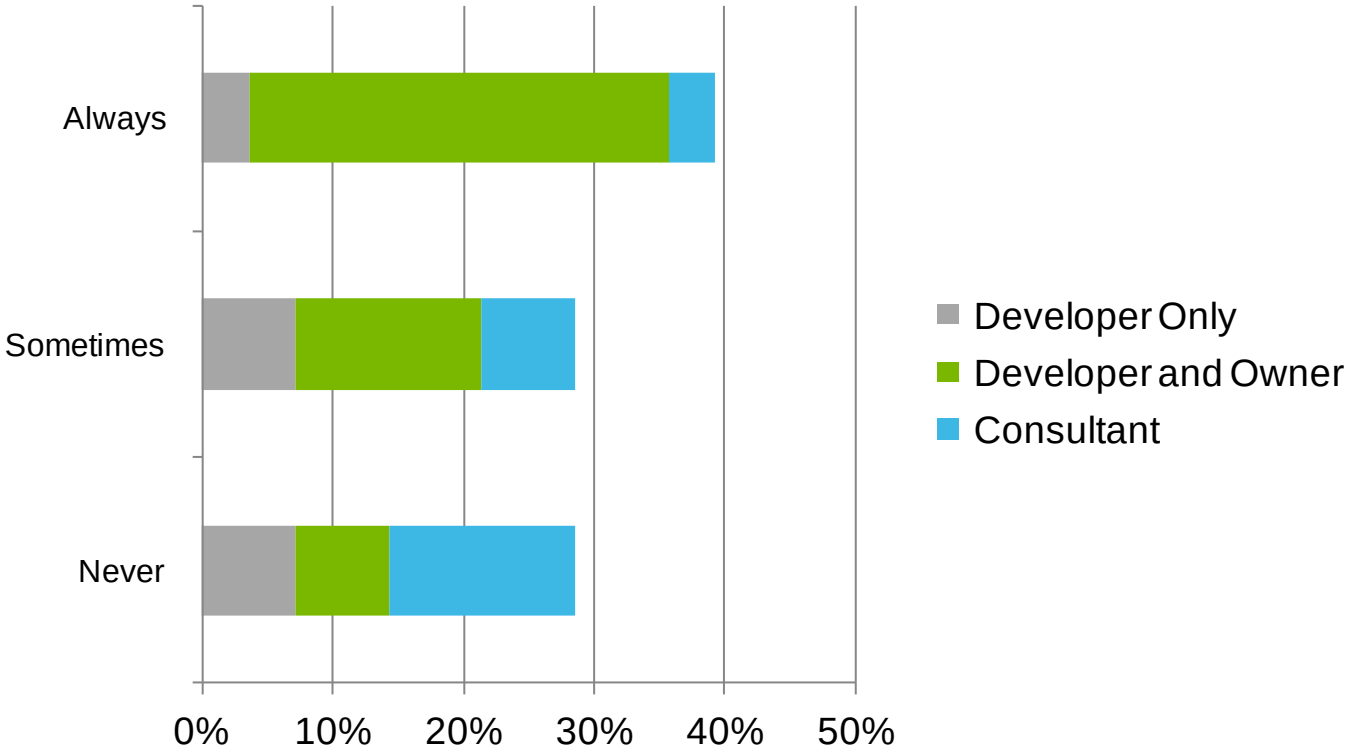
SETBACKS AND TURBINE SITING

In the absence of a requirement to do so, does your company as a standard practice perform any preconstruction noise impact modeling of the proposed wind project?



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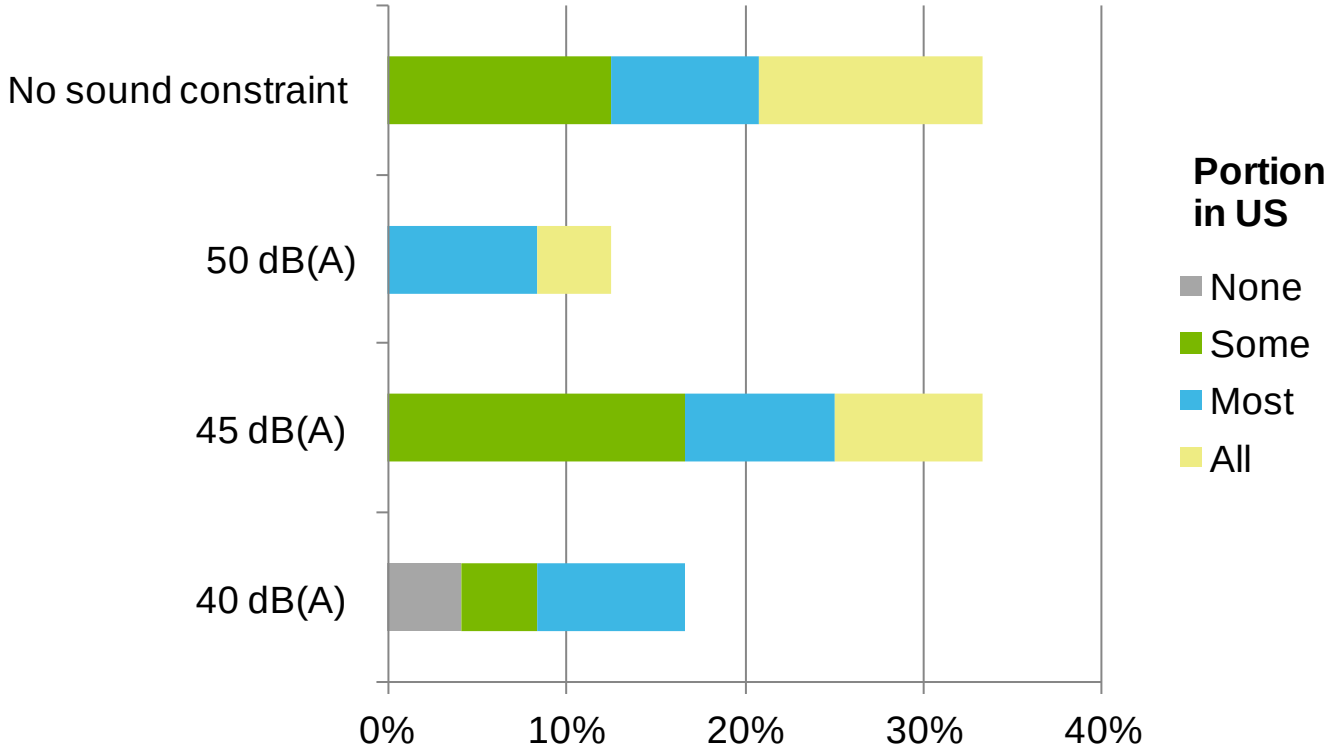
SETBACKS AND TURBINE SITING

In the absence of local or regional siting guidelines, what maximum allowable sound level do you use for the modeled contribution of wind turbines on participating dwellings?



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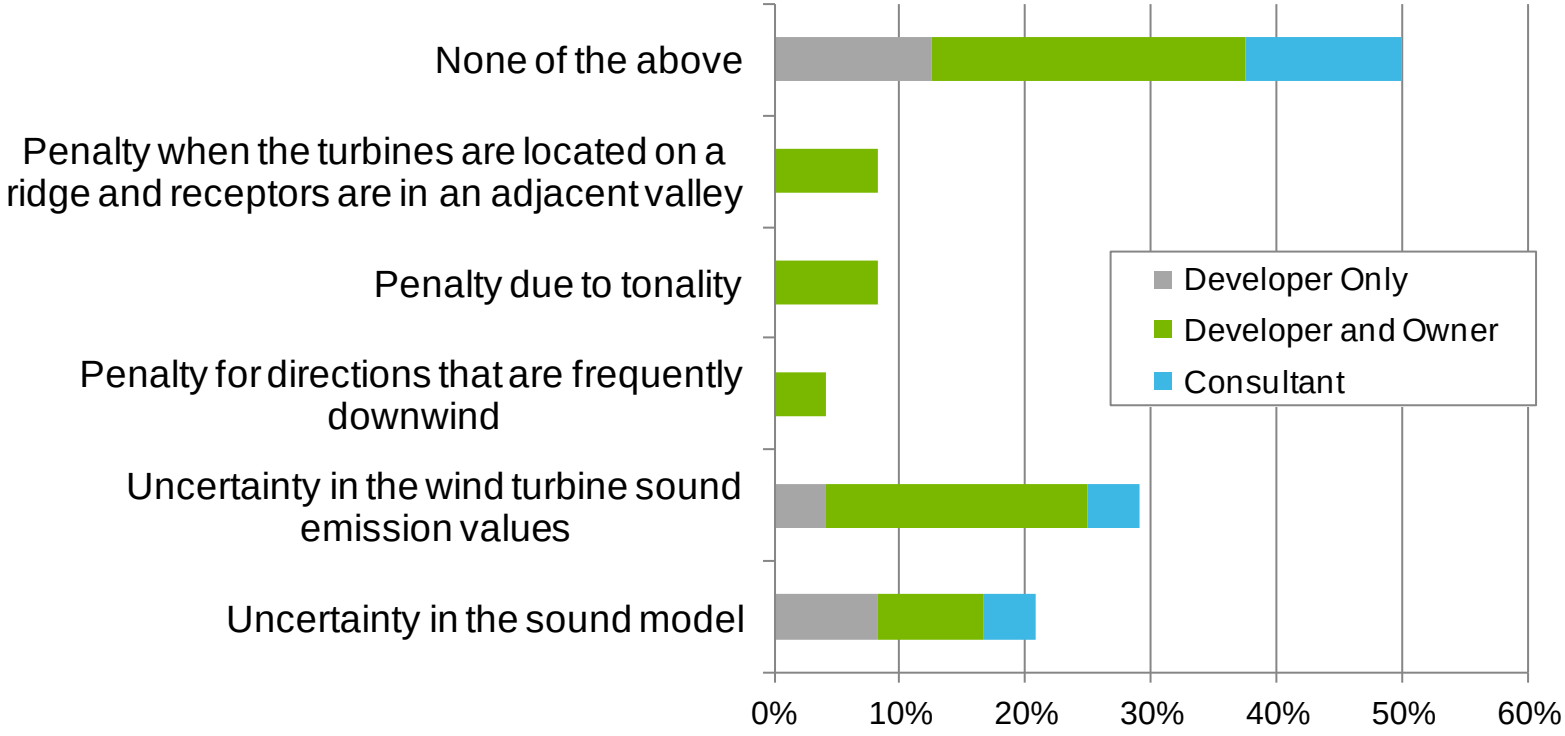
SETBACKS AND TURBINE SITING

In the absence of local or regional guidelines, does your company increase the setback due to wind turbine sound in consideration of the following (select all that apply)?



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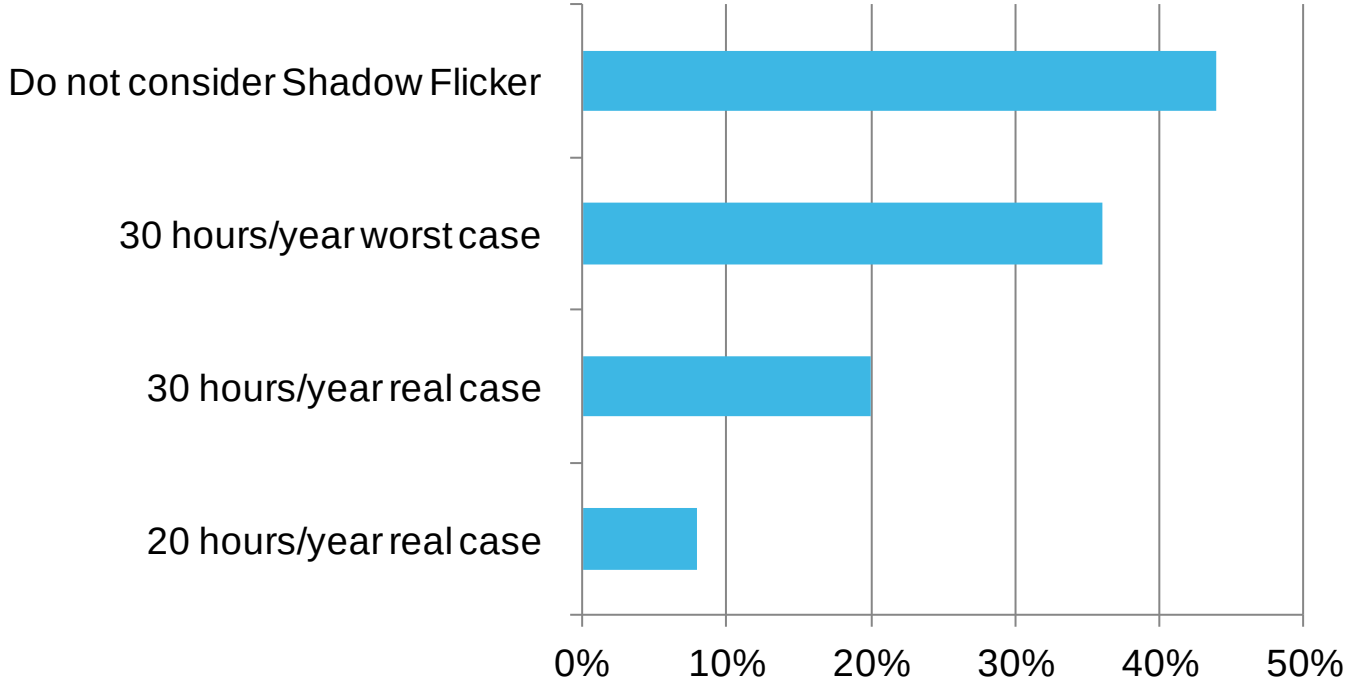
SETBACKS AND TURBINE SITING

In the absence of local or regional siting guidelines, which shadow flicker magnitude best characterizes your design target for occupied buildings? Select all targets that apply.



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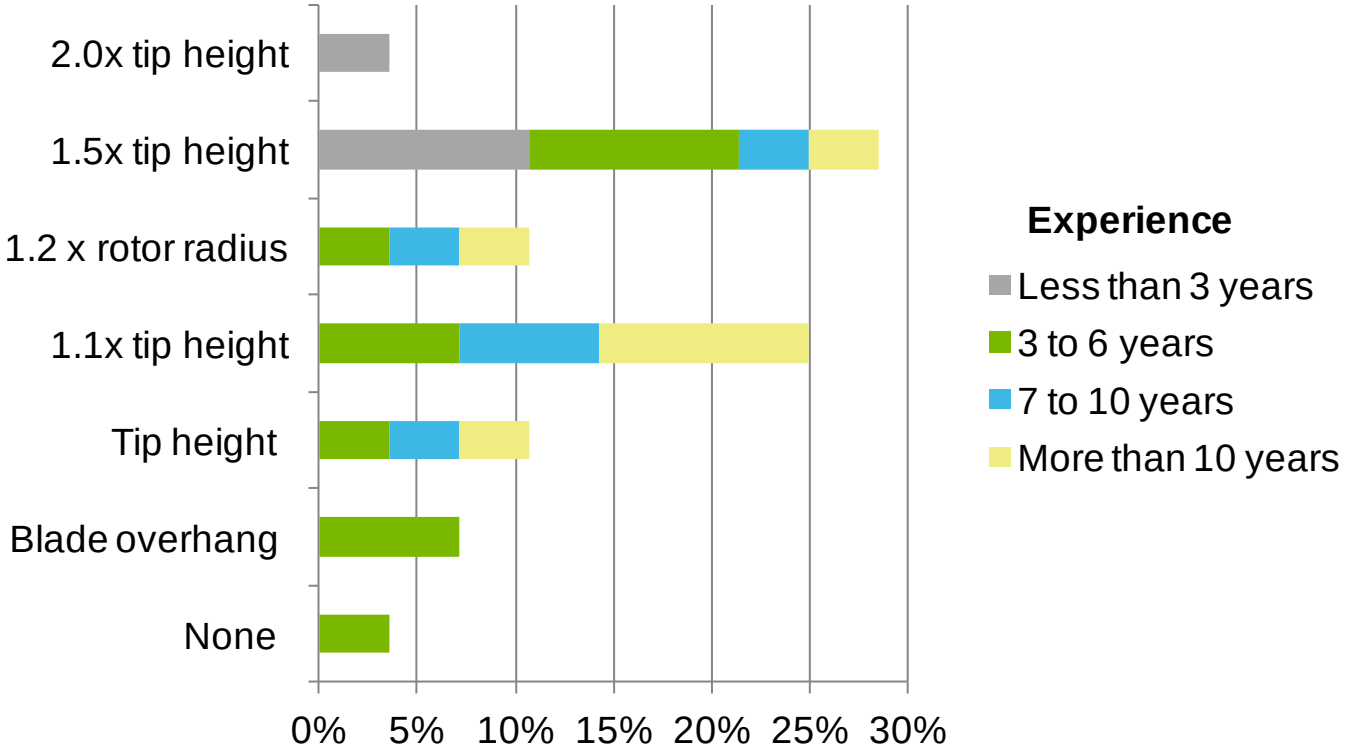
SETBACKS AND TURBINE SITING

In the absence of local or regional siting guidelines, which distance best characterizes the setback you typically use for wind turbines relative to unoccupied structures?



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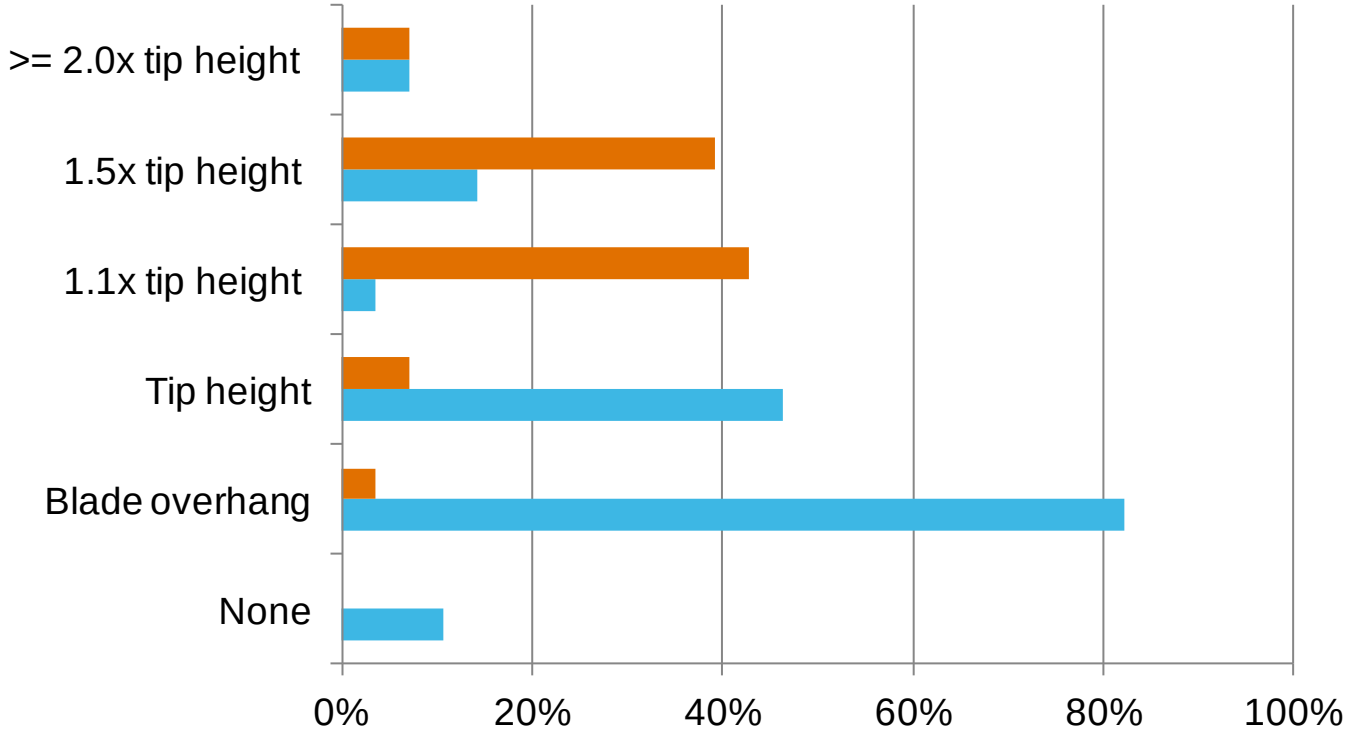
SETBACKS AND TURBINE SITING

In the absence of local or regional siting guidelines, what distance setback do you typically use for wind turbines relative to minor roads / major roads



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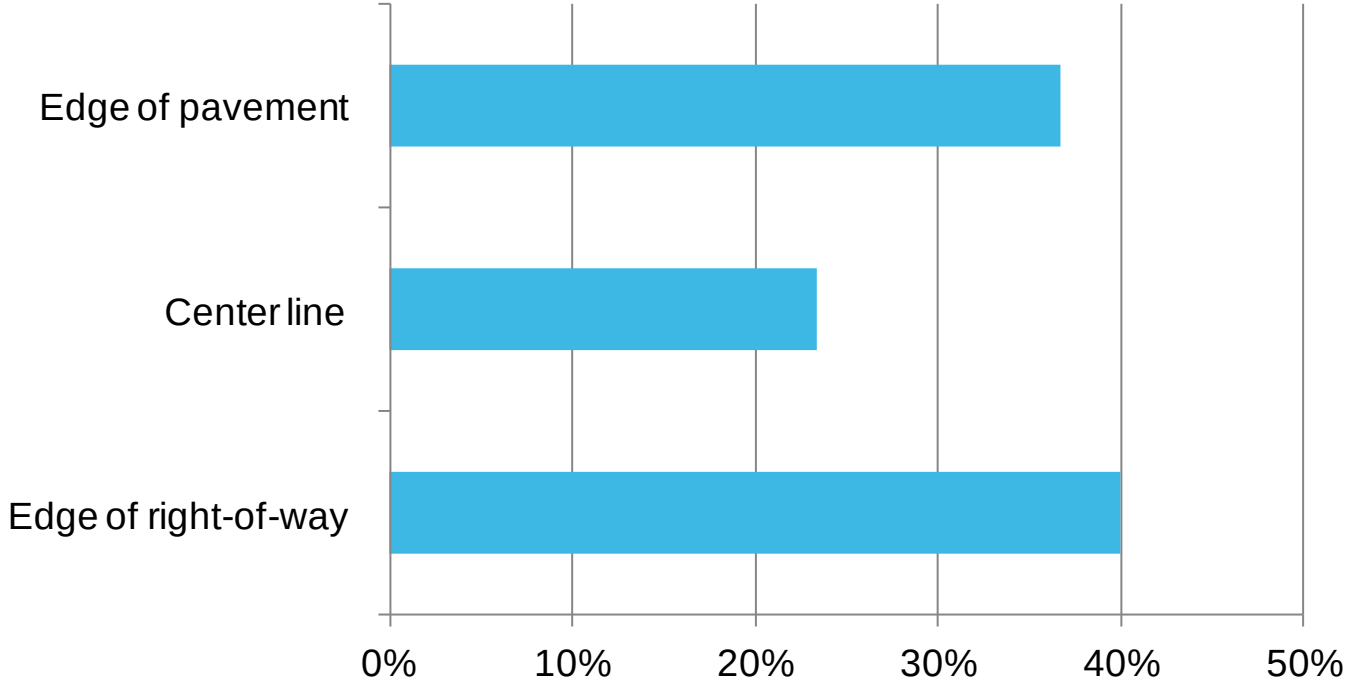
SETBACKS AND TURBINE SITING

For the road setback distances referenced in the previous question, do you prefer to measure relative to edge of right-of-way, edge of pavement, or center line?



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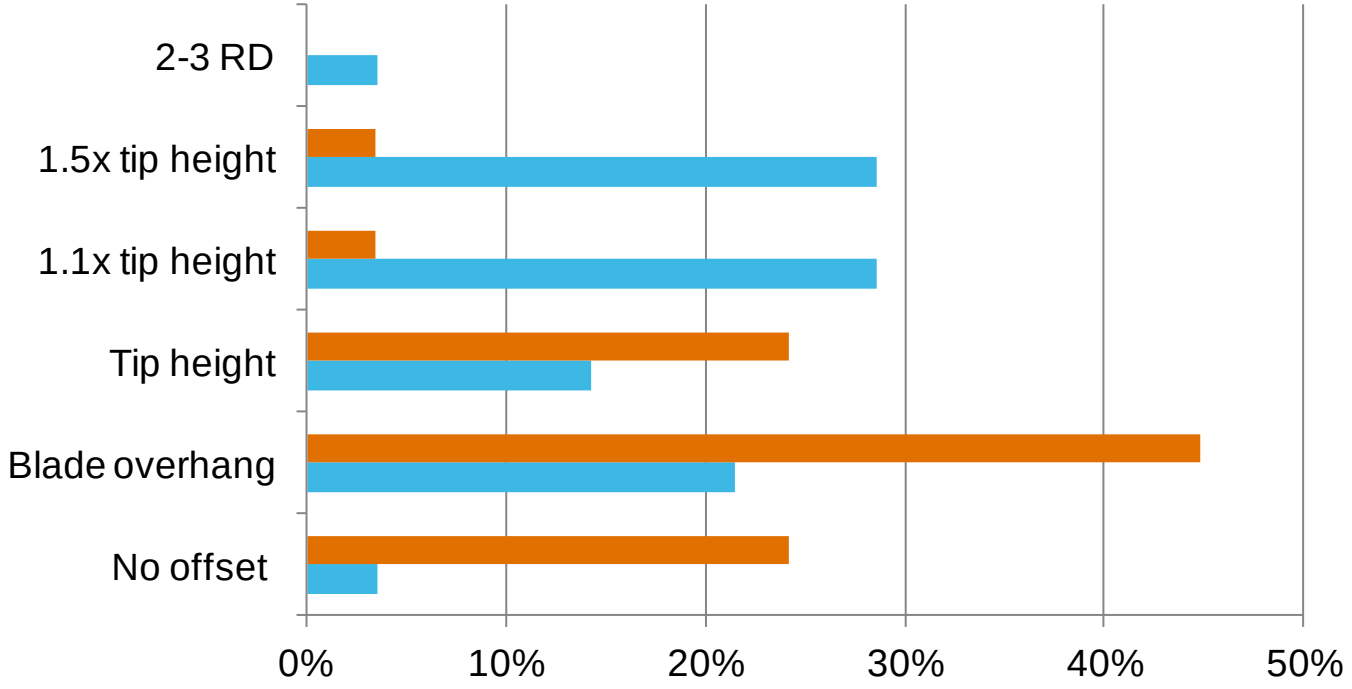
SETBACKS AND TURBINE SITING

In the absence of local or regional siting guidelines, which setback distance best represents the value you typically use for participating / non-participating property lines?



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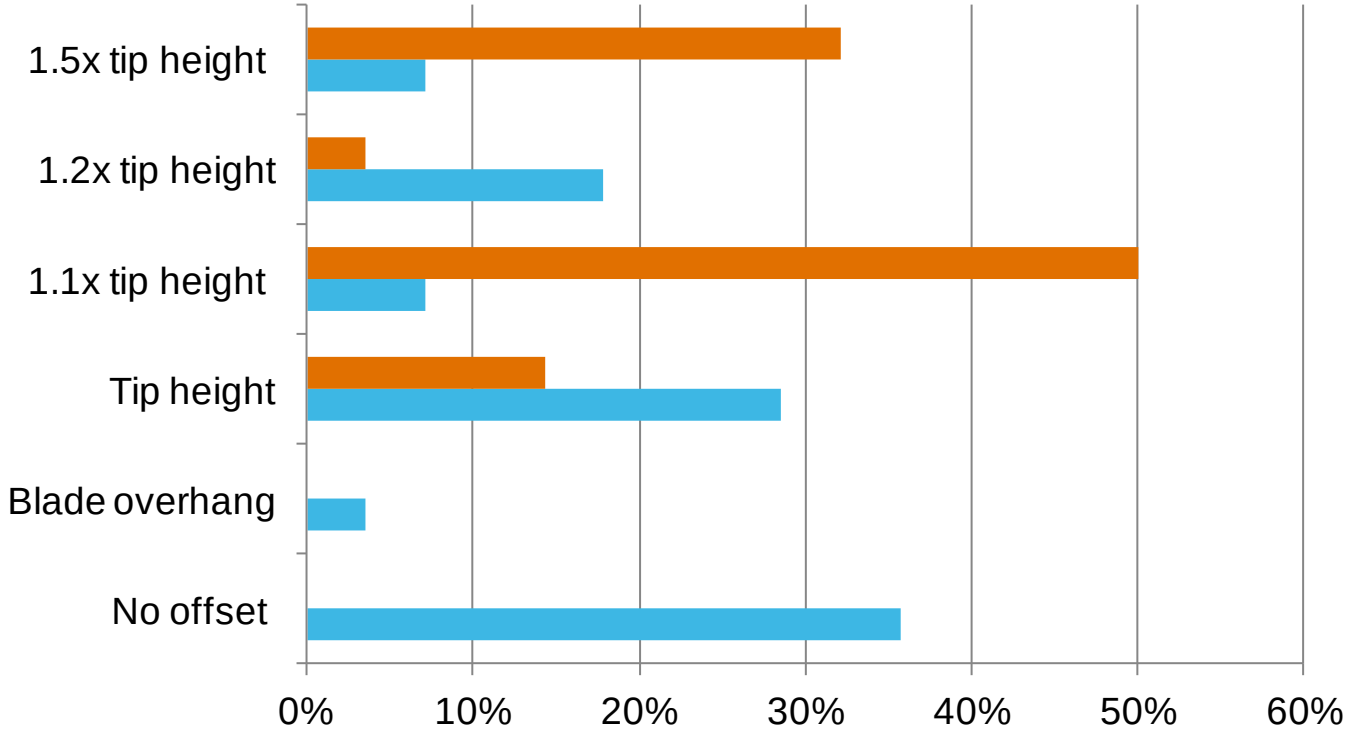
SETBACKS AND TURBINE SITING

Which setback distance best represents the value you typically use for minor distribution-level electric / major overhead transmission lines?



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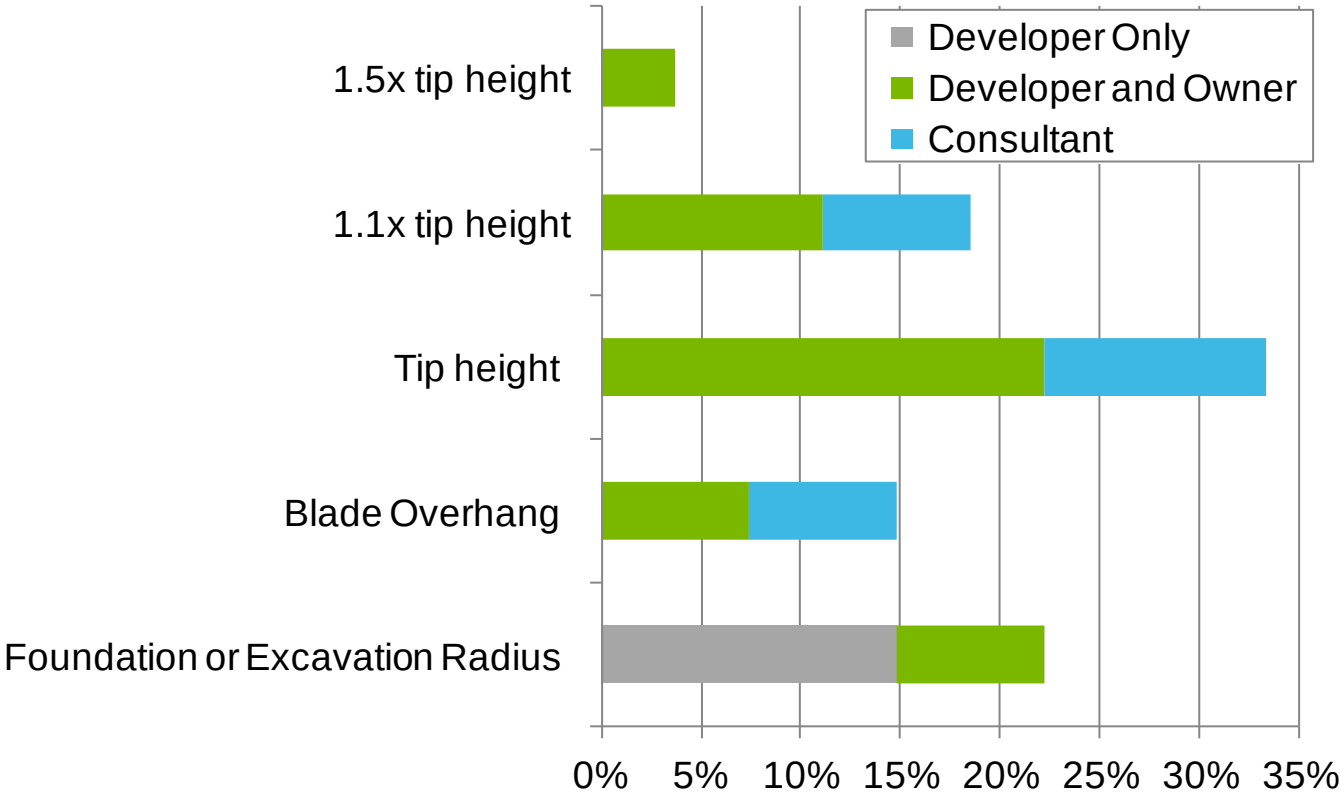
SETBACKS AND TURBINE SITING

Which setback distance best represents the value you typically use for underground pipelines such as oil and gas?



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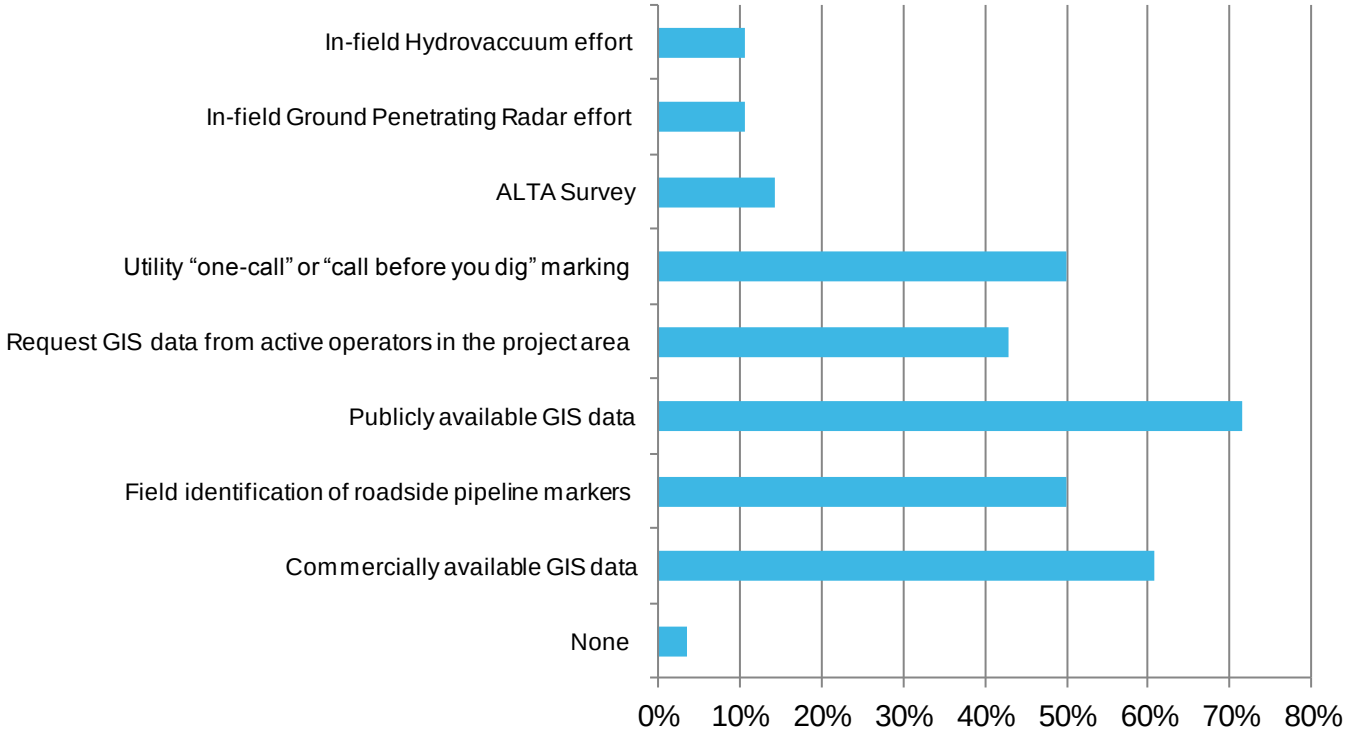
SETBACKS AND TURBINE SITING

Which of the methods below do you use to accurately identify the location of underground pipelines such as oil and gas before the project is turned over to the general contractor? Please check all that apply.



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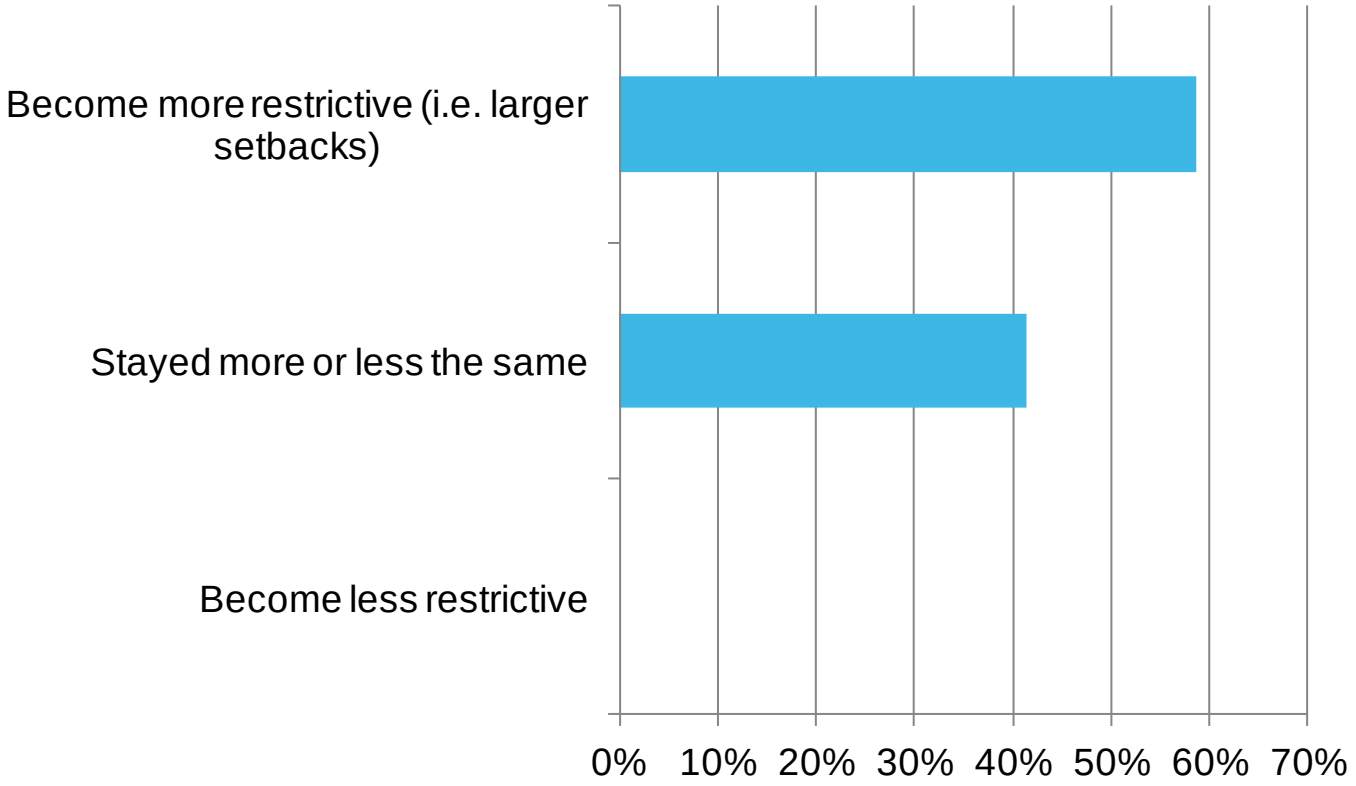
SETBACKS AND TURBINE SITING

How has your application of setbacks evolved over time?



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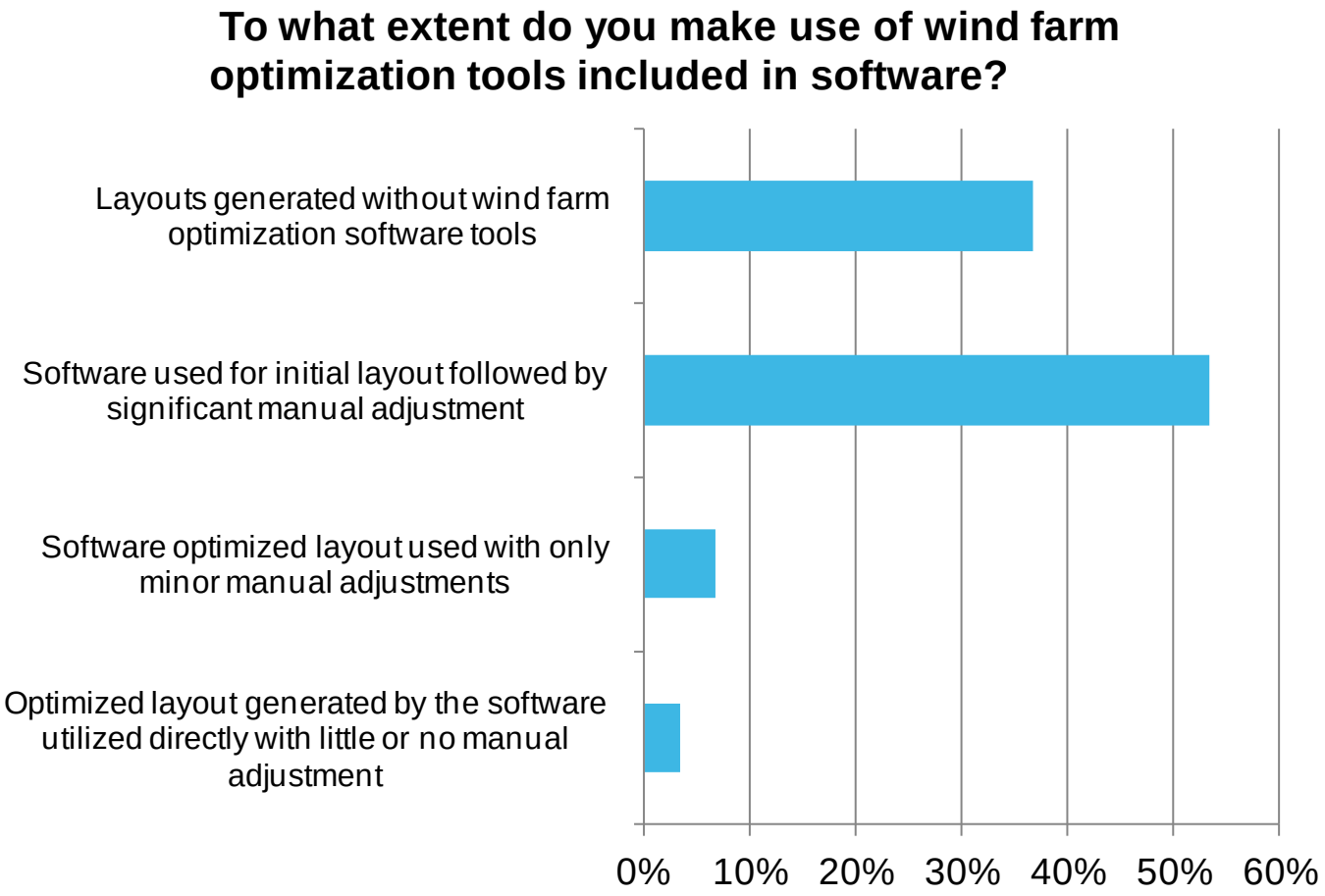
LAYOUT OPTIMIZATION



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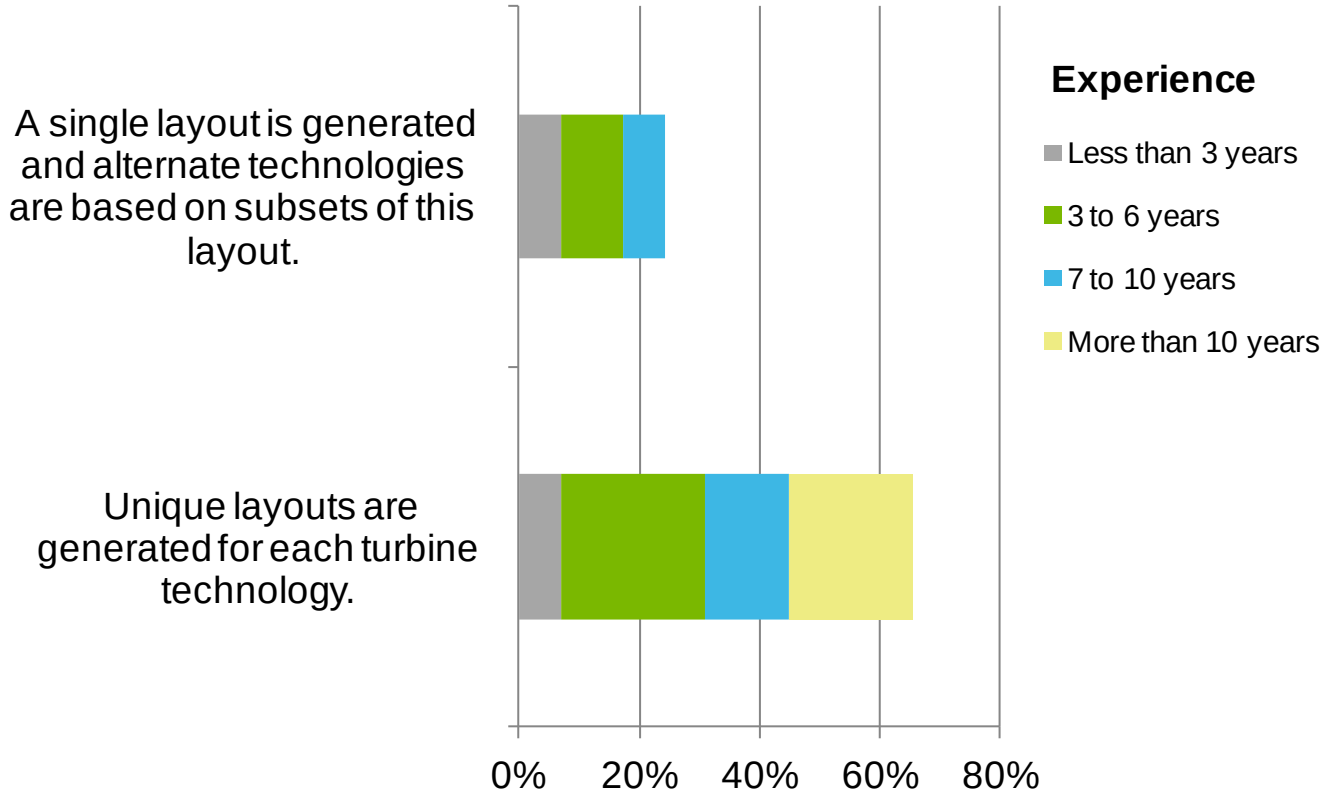
LAYOUT OPTIMIZATION

How do you typically optimize layouts when multiple turbine technologies are still in contention?



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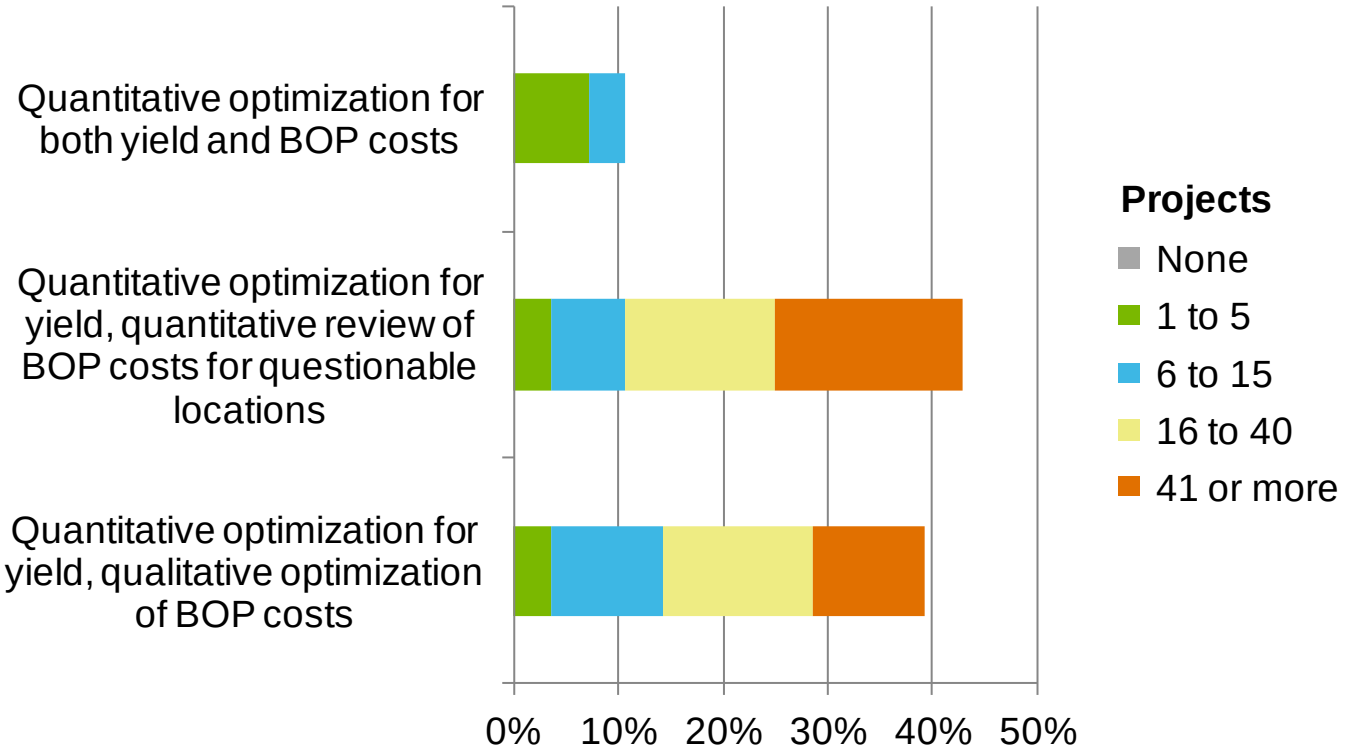
LAYOUT OPTIMIZATION

When optimizing an array, how much effort do you put into incorporating balance of plant (BOP) costs (roads, collector system, etc.) into the optimization?



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SUITABILITY CONSIDERATIONS

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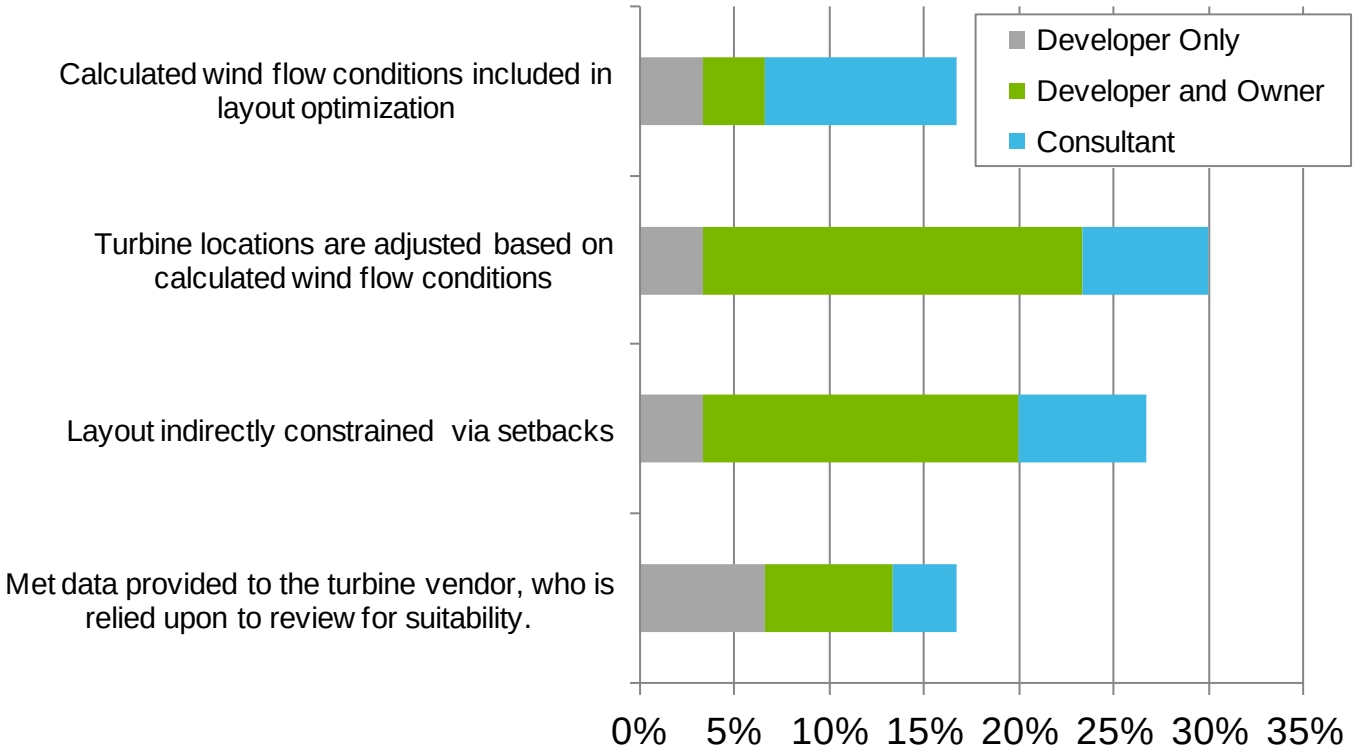

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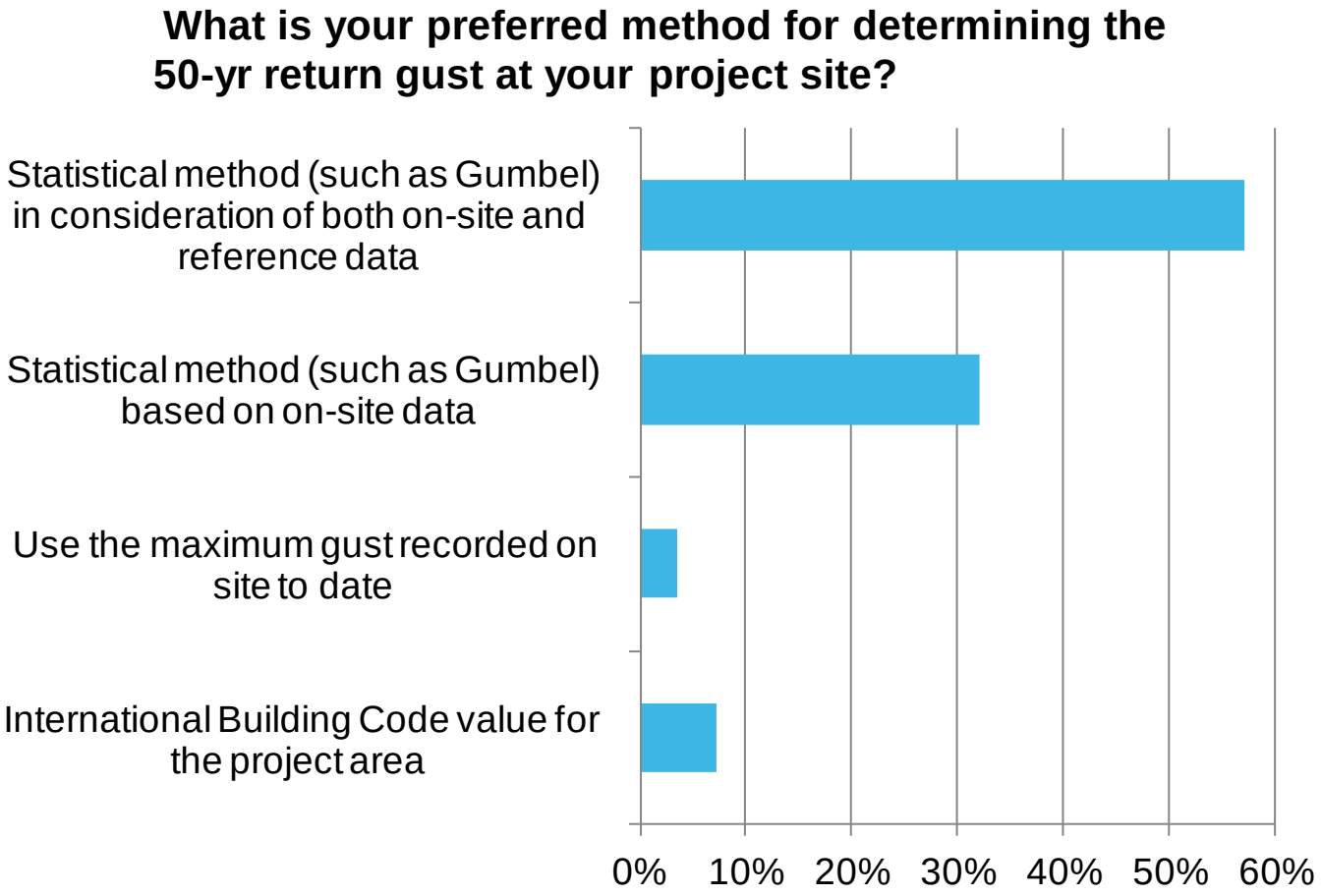

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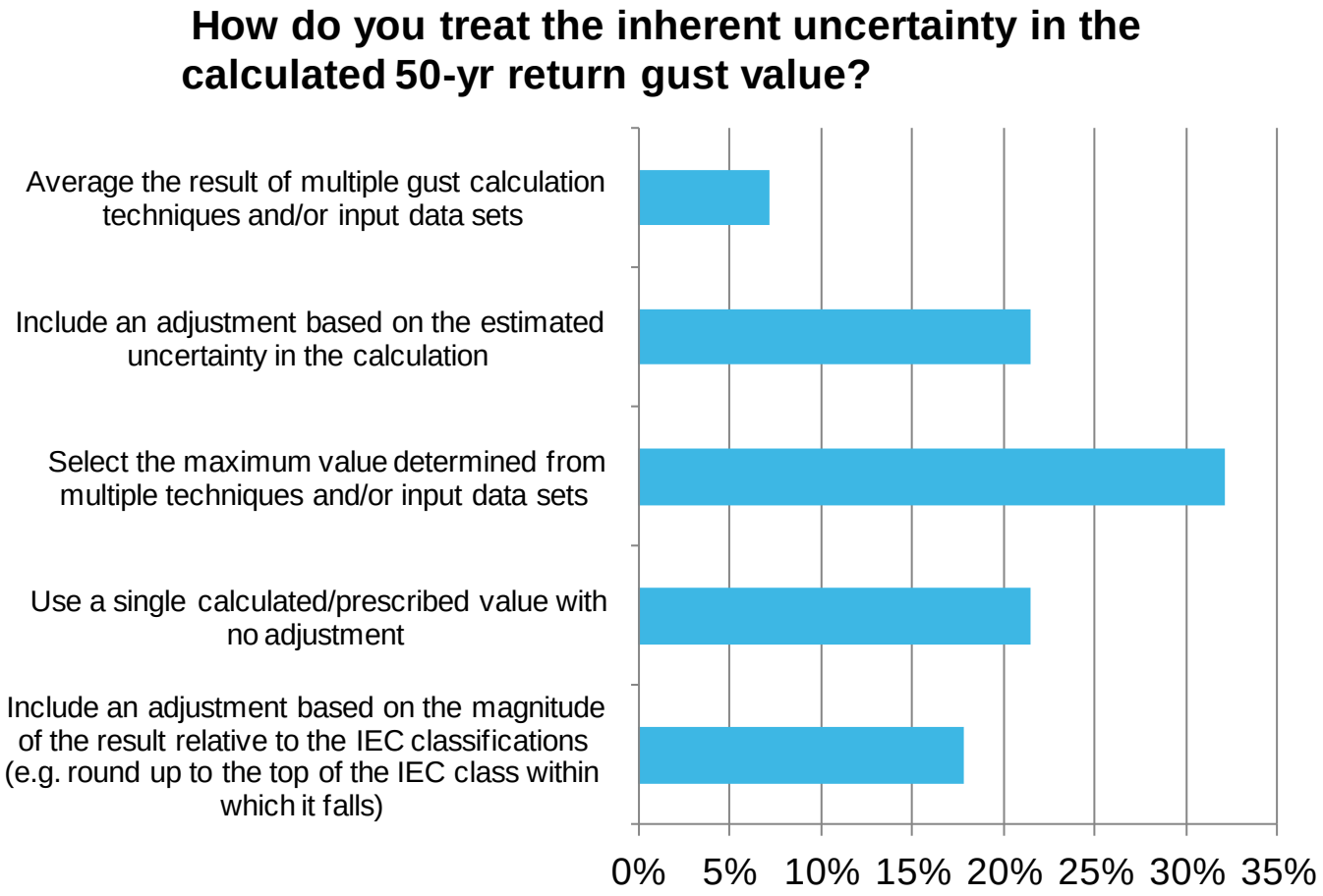

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COMMENTS AND CONCLUSIONS

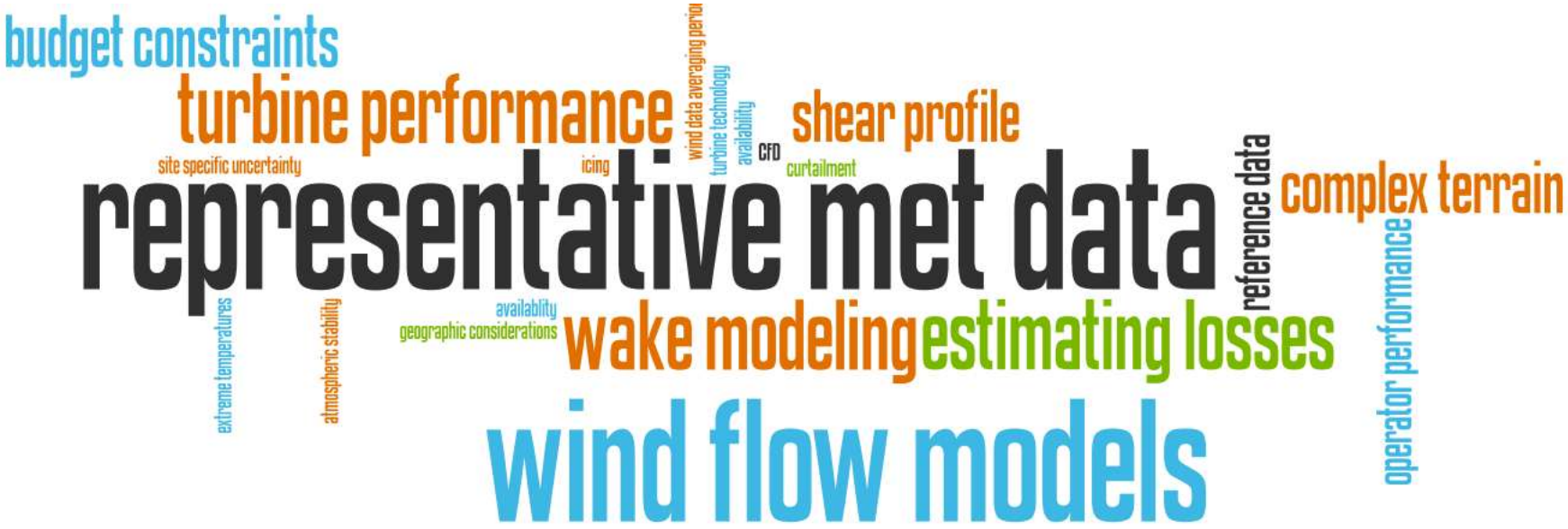
What, in your opinion, is one of the most significant barriers to optimizing the layout design of wind power projects?

Common Themes:

- Changing or unavailable data:
  - setbacks
  - landowner participation
  - BOP costs
  - turbine selection
- Accuracy of models (wind flow and wake)
- Ability to optimize:
  - Many variables to consider
  - Time and budgetary constraints

COMMENTS AND CONCLUSIONS

What, in your opinion, is one of the most significant barriers to accurately characterizing the yield and associated uncertainty for wind power projects?



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Thank You

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